

THE POLYCHÆTOUS ANNELIDS DREDGED BY THE U. S. S. "ALBATROSS"  
OFF THE COAST OF SOUTHERN CALIFORNIA IN 1904:  
III. EUPHROSYNIDÆ TO GONIADIDÆ.

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The present paper is in continuation of two parts already published under the same title and completes the Nereidiformia. Parts I and II were published in these PROCEEDINGS for June, 1909, and April, 1910, respectively. A fourth part dealing with the remaining Polychæta and completing the report is nearly ready for publication. The large number of species that it has been necessary to name and describe in this paper further illustrates the richness of the Polychæte fauna of California and particularly of Monterey Bay and emphasizes the incompleteness of our knowledge of the subject.

EUPHROSYNIDÆ.

Four species of *Euphosyne*, two of which are previously undescribed, represent this family.

*Euphosyne bicirrata* Moore.

*Euphosyne bicirrata* Moore. Proc. Acad. Nat. Sci. Phila., 1905, pp. 532-534, Pl. XXXIV, figs. 8-12.

Two specimens of 7.5 and 15 mm. long, each having 26 segments. The setæ are remarkably long, the notopodials often exceeding the width of the body, and agree in character and distribution with the type. There are six or seven pairs of gills on each somite, each consisting of two filaments which are subequal on the larger specimen and mostly distinctly unequal on the other; rarely one or two smaller gills are added. The caruncle of the smaller specimen reaches to the anterior border of V. Median tentacle exceeds two-thirds the caruncle, the distal half being filamentous. Middle cirrus between second and third gills from dorsum.

Stations 4,339, off Point Loma Lighthouse, vicinity of San Diego, 241-369 fathoms, green mud; 4,549, Monterey Bay, off Point Pinos Lighthouse, 56-57 fathoms, coarse sand, shells and rock.

*Euphosyne hortensis* Moore.

*Euphosyne hortensis* Moore. Proc. Acad. Nat. Sci. Phila., 1905, pp. 534-536, Pl. XXXIV, figs. 13-16.

Two specimens of nine and ten millimeters long have 29 and 31 segments, respectively. The caruncle reaches the middle of VI. The

branched and tufted gills form continuous rows of coarse filaments behind the palisades of setæ and occur in seven or eight pairs, of which the lowermost, occupying the interramal space, and the uppermost tend to split up. The middle cirrus is either opposite to the fourth or fifth gill or opposite the interval between them.

The setæ are somewhat more slender than on the original specimens, but agree with them in other respects. The dorsal ones project conspicuously above the gills and more or less cover the median dorsal area.

This species has much in common with *E. heterobranchia* Johnson, but lacks the smooth, cleft notopodial setæ of that species.

Stations 4,463, Monterey Bay, Point Pinos Lighthouse, 48-111 fathoms, rocky; 4,552, same locality, 66-73 fathoms, green mud and rocks.

***Euphrosyne dumosa* sp. nov.** Pl. XV, figs. 12-17.

A stout but little depressed species with conspicuous gills and much of the aspect of an Arctian caterpillar. The type, having 34 segments, is 16 mm. long, with a maximum width, exclusive of the setæ, of 8 mm. and a maximum depth of about 4.8 mm., exclusive of the gills and setæ, and of 6 mm. including them. The cotype is 10 mm. long and 4 mm. wide with 32 segments.

Prostomial caruncle long and narrow, the tip of the crest reaching to or slightly beyond the furrow VI/VII, the base to the middle of VI only; base and crest well-differentiated and separated by deep longitudinal furrows; the crest smooth, not marked by distinct longitudinal grooves, continued forward by a low ridge to the furrow separating the palps. Eyes, two pairs; the dorsal immediately at the anterior end of the caruncle on each side of the median tentacle, conspicuous, black, round or slightly elongated; the ventral about one-half as large, very close together between bases of peristomial parapodia. Median tentacle situated at anterior end of caruncle, between dorsal eyes and composed of a short cylindrical ceratophore about as long as the basal width of the caruncle and a short style which is incomplete in both specimens. Paired tentacles minute papillæ immediately ventral to ventral eyes. Palps smooth, flattened, ovate pads, separated by a median fissure and continuous by their contracted anterior ends with the peristomial parapodia. A low facial ridge runs forward and downward to the fissure between the palpi. Mouth bounded by palps in front, somite IV at the sides and the furrowed lip of V behind.

Peristomium coalesced with prostomium and the anterior part of the latter largely concealed between its forwardly directed para-

podia. Segments 32 to 34, strongly differentiated ventrally by deep furrows which are well-marked dorsally also, except in the median area where they become obsolete in a series of biconvex intersegmental areas. Median naked field about one-fifth total width of dorsum, the parapodial areas densely covered with rows of branchiæ and setæ and occupying the rest of the dorsum. Ventrally a slight neural groove runs from the posterior lip to the pygidium. Pygidium minute, situated between the last pair of posteriorly directed parapodia and bearing a pair of appressed vertical lamellar anal cirri with thickened borders.

Parapodia of the usual form, the notopodia sessile and dorsal; neuropodia lateral, slightly projecting, low lamellæ, overlapping the ventral end of the notopodia from behind. Cirri usually about equal to gills in length, but sometimes slightly longer or shorter, rather stout, gently tapered. Notocirrus usually the shortest of the three, reaching only slightly beyond the middle line and situated slightly mediad of the setæ palisade and a little anterior to the branchiæ. Middle cirrus in line with notocirrus and opposite interval between third and fourth or fourth and fifth gills from the dorsum. Neurocirrus similar, situated just within the postero-ventral margin of the neuropodial fascicle of setæ.

Branchiæ borne on all setigerous segments, usually ten (but sometimes nine or eleven) pairs on middle segments, the three ventralmost in the interramal area much crowded and often in actual contact or even with their stems partially coalesced. Each gill (Pl. XV, fig. 12) consists of a well-defined, stout stem bifurcated into a pair of nearly symmetrical trunks which divide dichotomously three or four times and end in rather slender, cylindroid, pointed filaments often half the total height of the gill. The angles of bifurcation are wide and the branching spreading in a plane so that the twigs of neighboring gills intercross. In the oral region the number of gills is somewhat reduced, and on somite I there are only six pairs with more or less coalesced bases and rather short filaments often thickened in the middle. The latter condition sometimes appears on other gills, but usually the filaments are extended and of regular diameter.

Notopodial setæ (Pl. XV, figs. 13-15) arranged in a long palisade of three rows running the entire length of the gill series. All are hollow, brittle, calcareous, translucent and white, or the granular contents of some of the larger ones slightly yellowish. All are relatively short and few project beyond the ends of the gills. Serrate bifid setæ are unusually numerous and appear not only to make up the anterior

series completely, but to enter largely into the formation of the other rows, especially at the dorsal end. Their ends have the form shown in figures 15, 15*a*, both forks being gently curved, tapered and strongly serrated along the inner borders, the longer being about twice as long as the shorter and without a widened region. Such setæ appear to be absent from I, but are alike on other segments and are usually distinctly shorter than the gills. They seldom show any trace of internal annulation or cameration. Most of the setæ of the second and third rows are of the simple spurred form (Pl. XV, figs. 13, 14) with nearly straight, smooth tips, those of the second row being longer and stouter, many of them reaching beyond the gills, those of the third row shorter than the serrate setæ. At the extreme ventral end of the palisade is a small compact tuft of much shorter setæ with very short tips.

Neuropodial setæ (Pl. XV, figs. 16 and 17) arise in several rows from an elliptical area. Those in the dorsal part of the bundle are nearly twice as long as the neurocirrus, but ventrally they become shorter until the most ventral are scarcely one-third as long as the cirrus. They have the general form of the smooth notopodial cirri, but are rather more slender and have longer, more curved ends and longer spurs.

Except for a pair of dusky spots on each segment of the median dorsal field and some dusky suffusions elsewhere, both specimens are colorless.

Stations 4,410, off Santa Catalina Island, 178-195 fathoms, gray sand, gravel and rocks (type); 4,470, off Point Pinos Lighthouse, Monterey Bay, 61-69 fathoms, hard gray sand.

***Euphrosyne limbata*** sp. nov. Pl. XV, figs. 7-11.

The single strongly curved specimen has a length of 17 mm., a maximum width of 7 mm., and a depth of 3 mm.; segments 36.

Prostomial caruncle short, beginning at posterior border of II and reaching barely beyond caudal border of IV; low, depressed rather than compressed, the base narrow and overlapped laterally by the spreading crest which reaches slightly beyond the base posteriorly also. Eyes two pairs, the dorsal black, somewhat elongated, slightly larger than the ventral, situated close together at the sides of the anterior end of the caruncle; ventral eyes smaller, nearly touching at median line, situated at ventral end of a low ridge which continues the caruncle forward and ventrad. Median tentacle situated as usual at anterior end of caruncle between dorsal eyes, consisting of a stout cylindrical ceratophore about one-third length of caruncle and a

minute conical style about one-half as long as the ceratophore. Paired tentacles minute papillæ immediately ventro-lateral of the ventral eyes. Palps smaller than usual, irregularly ovate with narrower prolongations not continuous with the peristomial parapodia, but entering the cleft between them. Mouth bounded by rugous lips formed laterally by III and IV and posteriorly by IV and V.

Segments 36, all well defined, especially ventrally where they are superficially wrinkled. Neural furrow slight, median dorsal naked field slightly exceeding one-fifth of total width, the triangular intersegmental areas rather obscure. Caudal cirri short and thick, each folded longitudinally on itself so that the lamellar form is obscured.

Parapodia as in *E. dumosa*. Notocirrus arising just dorsad (mediad) and slightly caudad of the notopodial setæ, rather short, simple, tapered and reaching slightly beyond the middle line. Neurocirrus similar, arising just within ventro-posterior portion of setæ fascicle. Intermediate cirrus situated about three-fifths length of setæ palisade from its dorsal end or at least ventral to its middle, opposite interval between sixth and seventh or fifth and sixth gills from the dorsum and between the setæ palisade and series of gills.

Branchiæ (Pl. XV, figs. 7, 8), usually twelve pairs on each side of middle segments, but somewhat fewer toward the ends of the body. The nine dorsalmost form a straight row well behind the setæ and cirri, the three lowermost occupying the interramal space and usually separated from the others by a short interval. Each gill has a very short trunk soon divided into two, each of which is again divided dichotomously about four or five times to form thirty or more long terminal filaments. All parts of the gill are slender and the terminal twigs so numerous and long that they form a dense interlacing mass between the rows of setæ, the longest of which, however, rise well above and shelter them.

Setæ all colorless and transparent and of one type, none being serrate or strictly bifid. Notopodials (Pl. XV, fig. 9) erect in a narrow palisade of three irregular rows, those of anterior and posterior rows small and less than the gills in length; those of the middle row are fully twice as long and thick and rise conspicuously above the gills. All are alike hollow, calcareous and brittle, with rather long, slightly curved, smooth tips strongly annulated or camerated within and bearing a prominent, subterminal, divergent spur. Neuropodial setæ are of the same type and those in the ventral part of the bundle (Pl. XV, fig. 10) differ little except in length from the longer notopodial setæ. Dorsal neuropodials (Pl. XV, fig. 11), however, are much

longer and more slender, with very acute, straight tips and, as stated above, project laterally as very prominent fringes.

No color remains.

The only specimen comes from station 4,420, off San Nicholas Island, 32-33 fathoms, fine gray sand.

This species is evidently closely related to *E. maculata* Horst from Timor; but lacks serrated, ringent dorsal setæ. Compared with *E. dumosa*, it appears remarkably broad and depressed, besides differing in many technical characters.

#### AMPHINOMIDÆ.

*Chloëia pinnata* sp. nov. Pl. XV, figs. 1-6.

A very pretty, small and slender species of a slightly depressed, fusiform shape, tapering most toward the caudal end. The type is 26 mm. long, 6.5 mm. wide at XI, where it is 5.5 mm. deep, and has a spread of setæ of 12 mm.; segments 26. Other specimens vary in length from 7 to 30 mm. and have from 17 to 28 segments.

Prostomium coalesced with peristomium, its broadly truncate anterior border produced laterally round the peristomial parapodia; ventrally it appears as a tumid elliptical pad divided by a median longitudinal cleft and reaching the mouth; dorsally somewhat T-shaped, the broad anterior end extending laterally, while posteriorly it is contracted between the parapodia of somites I and II. Caruncle arises from the prostomium and reaches to the anterior or occasionally to the posterior border of IV, but is entirely free from these segments, over which it passes like a flowing plume. Two longitudinal furrows divide it into a compressed crest with accordion-plaited sides and smaller basal ridge also divided by transverse furrows into twelve or thirteen deep crenulations, each marked, like the crest folds, with a small brown spot. Eyes two pairs, black, equally conspicuous, but the anterior slightly the larger, situated at sides of anterior end of caruncle, the anterior slightly in advance, the posterior slightly behind the anterior border. Median tentacle arising from a low, smooth elevation coalesced with anterior end of caruncle, the style moderately slender, tapered, smooth, suberect, about one-fourth longer than the caruncle, but fragile and seldom complete. Paired tentacles sessile, in contact between anterior eyes, similar in form to median tentacle and about one-half as long.

Peristomium and its parapodia completely coalesced with prostomium, not appearing as a distinct segment. Somite II well-differentiated, divided ventrally by the mouth and forming the rugous lateral

lips. Mouth bounded behind by III which is united with IV to form the rugous posterior lip. Remaining segments few, large, distinct, strongly differentiated by deep furrows below and more shallow ones above; lateral borders deeply and coarsely serrated; entire ventral surface and median dorsal (interbranchial) field quite smooth. Segments increase in size to XI, then gradually decrease to the small bilobed pygidium which bears a pair of thick, truncate, cylindrical, appressed cirri about as long as the lateral tentacles.

Parapodia simple but rather prominent, lateral swellings producing the coarse lateral serrations, biramous, the notopodial and neuropodial tubercles widely separated and each bearing a large setigerous sac with elliptical orifice and an eversible rim, the notopodial orifice facing laterad and slightly dorsad and caudad, the neuropodial laterad and caudad. Toward the ends the parapodia become smaller and the setæ tufts gradually reduced; the anterior ones shift toward the dorsum, the first or peristomial foot being strictly dorsal; approaching the caudal end the setæ fascicles are directed more and more caudad.

Notocirri arise at the caudo-dorsal border of the notopodial tuft of setæ and reach to the base of the corresponding cirrus of the opposite side or on posterior segments beyond it. Cirrophores long, slender, terete, nearly as long as the segments to which they belong; styles flagelliform, three to three and one-half times as long as the cirrophores. Neurocirri arise within the lips of the setæ sacs on the ventral side of the neuropodial fascicle; they consist of short and obscure cirrophores and long, slender, fragile, flagelliform styles equalling the notocirri on middle segments, but diminishing in size posteriorly and also anterior to V. The first three parapodia have the cirri relatively short and stout, the notocirrus considerably shorter than the neurocirrus. They also possess a third much smaller cirrus situated immediately dorsal to the notocirrus and probably representing the gills; they are similar to the notocirri and that on the peristomium is longest.

Branchiæ begin on somite IV and continue, gradually diminishing in size, to the caudal end. They arise on the posterior border of the dorsum of their segments, separated by about one-third of the total width, and lie nearly flat on the dorsum, reaching caudad over the succeeding segment so that they are slightly imbricated. Form broadly suboval, lamellar, bipinnatifid; composed on middle segments of a tapered and somewhat sinuous axis bearing alternately on each side about eight simply pinnate branches diminishing in size and complexity distally, where the series is completed by two or three simple pinnæ. Toward the ends of the body they become smaller, with a diminished number of pinnæ.

Proboscis protruded on many specimens to varying degrees and presenting very different aspects. On the type it is a short truncate cylinder 3.5 mm. in diameter and equally long, divided by three furrows into as many zones: first, a soft, somewhat inflated basal zone which, because of the incompleteness of the furrows in a narrow medial dorsal region, here encroaches on the other rings to the end of the proboscis; second, a narrower, firm and muscular middle ring and, third, a still shorter terminal muscular disk of a deep brown color with a central rugous area and a slight vertical furrow dividing it to the margins. On other specimens the basal annulus is much larger and more inflated, the terminal disk is sometimes folded together along the vertical furrow in partial retraction, and sometimes in complete extension has the rugous area protruded as a prominent rounded mass turned toward the dorsum to conceal the mouth from below and marked by a slight median furrow and numerous, slightly sinuous, transverse raised lines. Still other specimens have this distal region much more extended to a length exceeding all the rest of the proboscis, and bearing the large orifice at the end of the flat, smooth and soft dorsal part, the deep spoon-shaped or ventricose sides and venter being completely formed by the rugous area.

Setæ all nearly or quite colorless, tubular, with soft, granular contents, very brittle. When massed the setæ are sometimes distinctly yellow and those of some of the younger specimens exhibit a beautiful satiny luster. Notopodials in somewhat whorled, suberect tufts, becoming longer and more recumbent toward the caudal end. They are rather stout, slightly curved and tapered to rather blunt points, below which, at a varying distance, is a spur, conspicuous on the more ventral setæ (Pl. XV, fig. 1) which are truly bifid, nearly obsolete on dorsal setæ (Pl. XV, fig. 3). Most notosetæ of middle segments are smooth or nearly so, but some (fig. 2) exhibit slight serrations, and this may be the normal state of unworn setæ. Posteriorly the setæ become longer and usually lack the spur; anteriorly contrary changes occur. Neuropodial setæ much more numerous, slender and elongated, forming very dense tufts which spread laterad, but posteriorly more caudad. Posterior setæ are more elongated and truly capillary, but on some examples they exceed the body width, even on the middle parapodia. They are of the same type as the notopodials, but the spur is close to the tip and small or obsolete (Pl. XV, figs. 4, 5). Toward the ends of the body modifications similar to those affecting the notosetæ occur (Pl. XV, fig. 6).

Color. Probably richly colored in life, but most of the preserved



specimens are faded and colorless except for a wedge-shaped brown or purple spot in front of the lateral tentacles, a rich madder purple coloration of the notocirri and a brown spot at the end of each anal cirrus; others show traces of a more extensive purple coloration, especially on posterior segments. The under parts, including the neurocirri, are always colorless, as are the tentacles and one to three or four pairs of the anterior notocirri. Not infrequently also, the color is lost more or less completely from the styles of IV, V and VI, but the cirrophores always retain the deep purple color. A specimen from station 4,416 is of a fine rosy color above with a median series of white oval spots. Several specimens from station 4,454 have the notocirri brown and the ventral surface, proboscis and rarely portions of the dorsal surface spotted with sharply defined, quadrate, brown spots. Sometimes only three or four occur on the entire ventral surface, in which case some are likely to occur on the dorsum; sometimes they are much more numerous and in places crowded or even coalesced and rarely the spots are X-shaped.

*Chlocia pinnata* is one of the most abundantly represented and generally distributed species included in this collection. There are in all nearly three hundred specimens, about half of which came from stations 4,460, 4,475 and 4,552 and about twenty each from stations 4,349, 4,480 and 4,485, all of these being muddy bottoms. No less than ninety-seven were taken at station 4,475, from among which the type was selected.

The full list is as follows: Stations 4,309, Point Loma Lighthouse, vicinity of San Diego, 67-78 fathoms, fine sand, shells and rock; 4,310, same locality, 71-75 fathoms, fine sand and green mud; 4,322, off Point La Jolla, vicinity of San Diego, 110-199 fathoms, green mud and shells; 4,332, off Point Loma Lighthouse, 62-183 fathoms, gray and black sand with rocks; 4,339, same locality, 168-254 fathoms, green mud, fine sand and rock; 4,349, same locality, 75-134 fathoms, green mud and fine sand; 4,364, same locality, 101-129 fathoms, gray sand, mud and rock; 4,365, same locality, 130-158 fathoms, green mud; 4,366, same locality and bottom, 176-181 fathoms; 4,416, off Santa Barbara Island, 323-448 fathoms, dark green mud and rock; 4,418, same locality, 238-310 fathoms, dark mud, sand and rock; 4,420, off San Nicolas Island, 32-33 fathoms, fine gray sand; 4,423, same locality, 216-339 fathoms, gray sand with black pebbles and shells; 4,454, Monterey Bay, Point Pinos Lighthouse, 65-71 fathoms, green mud, sand and gravel; 4,460, same locality, 55-167 fathoms, green mud and gravel; 4,464, same locality, 36-51 fathoms, soft dark

gray mud; 4,475, same locality, 85-142 fathoms, soft green mud; 4,480, Monterey Bay, off Santa Cruz Lighthouse, 53-76 fathoms, dark green mud and sand; 4,485, same locality, 39-108 fathoms, soft green mud and sand; 4,510, Monterey Bay, off Point Pinos Lighthouse, 91-184 fathoms, gray mud; 4,522, same locality, 130-149 fathoms, gray sand and shells; 4,523, same locality, 75-108 fathoms, soft dark mud; 4,552, same locality, 66-73 fathoms, green mud and rocks; 4,553, same locality, 65-74 fathoms, rock.

#### NEPHTHYDIDÆ.

*Nephtys cæca* (Fabricius) Oersted.

*Nephtys cæca*, Ehlers, Die Borstenwürmer, 1869, pp. 588-617, Taf. XXIII, figs. 10-34; Wiren, Vega Expeditionens, II, pp. 392-397, Taf. 30 and 31.

After puzzling a long time over the many specimens of *Nephtys* in this collection, I have been unable to come to any satisfactory conclusion regarding the number of species actually represented, and have, therefore, tentatively begged the question and followed Wiren in listing all of the forms represented under the above name. As a matter of fact, scarcely a single specimen can be confidently said to be typical *N. cæca*, though a number differ from it only intangibly. Most of them, in having the neuropodial postsetal lip much larger than the corresponding part of the notopodium, resemble *N. hombergi* Aud. and M. E. (= *N. assimilis* Oersted, Malmgren). Here belong especially those from stations 4,443, 4,462, 4,482, 4,485, 4,510, 4,523 and 4,548, all in Monterey Bay. One lot (station 4,436), in the almost total absence of parapodial lamellæ, approaches very closely *N. ciliata* (Müller) Rathke and has the rami widely separated as in *N. incisa* Malmgren but all of them have more segments than the latter. Specimens from stations 4,306 and 4,549 also approach this type, but the lamellæ are better developed. Two small specimens (station 4,482) have the long setæ and long involute gills of *N. malmgreni* Theel (= *N. longisetosa* Malmgren non Oersted). Examples from many of the other stations present intermediate characters, and it is for this reason that I do not here separate the forms as I have done previously, though I am by no means convinced that more than one species may not be represented.

The specimens vary in size from little more than 1 mm. wide to 8 and 9 mm. wide, the largest invariably incomplete. Many of the smaller ones show a conspicuous color pattern in the form of an irregular brown or dusky spot on the prostomium and bars of the same color across many of the anterior segments.

Stations 4,306, off Point Loma Lighthouse, vicinity of San Diego, 207-497 fathoms, green mud, fine sand and gravel; 4,310, same locality, 71-75 fathoms, green mud and fine sand; 4,349, same locality, 81-134 fathoms, green mud and fine sand; 4,364, same locality, 101-129 fathoms, gray sand, mud and rock; 4,431, off Santa Rosa Island, 38-45 fathoms, varied bottom; 4,436 off San Miguel Island, 264-271 fathoms, green mud; 4,443, off Point Pinos Lighthouse, Monterey Bay, 32-37 fathoms, fine gray sand; 4,462, same locality, 161-265 fathoms, green mud; 4,464, same locality, 36-51 fathoms, soft dark gray mud; 4,475, same locality, 58-85 fathoms, soft green mud; 4,480, off Santa Cruz Lighthouse, 53-76 fathoms, dark green mud, sand; 4,482, same locality, 43-44 fathoms, soft green mud; 4,485, same locality, 39-108 fathoms, soft green mud, sand; 4,510, off Point Pinos Lighthouse, 91-156 fathoms, gray mud; 4,522, same locality, 130-149 fathoms, gray sand and shells; 4,523, same locality, 75-108 fathoms, soft dark mud; 4,526, same locality, 204-239 fathoms, soft gray mud; 4,538, same locality, 795-871 fathoms, hard gray sand; 4,548, same locality, 46-54 fathoms, coarse sand, shells and rock; 4,549, same locality and bottom, 56-57 fathoms.

#### NEREIDÆ.

The Nereidæ are represented less richly than in similar collections along the more northern shores of the Pacific side of North America. The absence of any of the large species of *Alitta* is especially noteworthy.

*Nereis procera* Ehlers. Pl. XV, fig. 18.

*Nereis procera* Ehlers, Die Borstenwürmer, 1868, pp. 557-559; Taf. XXIII, fig. 2.

Represented by a number of small specimens, 21 to 45 mm. long, in the atokous phase and all sexually immature, which agree closely with Ehlers' description and also with larger mature examples already reported in these PROCEEDINGS for 1909 from the littoral zone at San Diego and Monterey Bay. The jaws and paragnaths conform generally to Ehlers' description, but group V may be absent or represented by either one or two paragnaths and the band VII-VIII varies much in width. The number of segments varies from 60 to 75.

The setæ, studied on one specimen, are disposed as follows: On anterior parapodia the notopodium bears six or eight homogomphs with slender "fish-bone" appendages, the neuropodial supra-acicular fascicle contains four or five similar homogomphs and usually two stout heterogomphs with short, scarcely falcate appendages, and the

neuropodial subacicular fascicle two or three homogomphs and five or six heterogomphs like the above, together with a few heterogomphs with longer appendages. On middle segments the number of homogomphs increases, but the heterogomphs become stouter and fewer. By about XXXIX the slender notopodials are replaced by two stout homogomphs with short, stout, fusiform, nearly buried appendages. A specimen from station 4,425 has the parapodia longer with more pointed lingulæ than usual and the characteristic notopodial setæ apparently wanting, but in all other respects, including the paragnaths, is typical.

Several from station 4,496 have the color pattern well-preserved. The anterior end is ashy, marked with brown spots and streaks gradually fading out and disappearing at about XVIII, beyond which the cuticle exhibits a conspicuous iridescence on a pigmentless integument. A large triangular spot (formed of a central and two lateral lines) occupies nearly the entire dorsum of the prostomium with its base resting on the eyes. The segments are marked by a central transverse dash, a pair of paramedian dashes near the anterior end, a similar pair near the posterior end, and a pair of lateral spots. On the first few segments the anterior and posterior pairs of spots tend to unite into two lines.

Of greater interest are five male specimens in the epitokous phase, hitherto unknown, taken at station 4,355. All are small, varying from 17 mm. and 54 segments to 28 mm. and 67 segments. In the latter the anterior region is 10.6 mm. long. In all cases the anterior region has 14 setigerous segments besides the apodous peristomium.

Prostomium of the general form seen in the atokous phase, but rather shorter and more broadly rounded anteriorly and strongly bent ventrad so that the anterior eyes lie rather more than half beneath the posterior. Eyes of each side coalesced, but not especially enlarged, each being little more than one-fourth the prostomial width. Both have large lenses, the ventral looking ventrad and laterad, the dorsal dorsad and laterad. Tentacles about three-fourths as long as prostomium, but ventrad and regularly tapered. Palps directed ventrad, short, scarcely more than one-half length of prostomium, basal segment stout, distal minute.

Peristomium obscurely biannulate with a narrow, feebly separated anterior ring. Tentacular cirri all short, rather distinctly but irregularly articulated; posterior dorsal reaches to V, anterior dorsal to beyond middle of III, and the two very short ventral cirri scarcely beyond the anterior border of II. On the largest specimen, which has the anterior segments more extended, the cirri are relatively shorter.

Pygidium minute, top-shaped, bearing a pair of rudimentary parapodia, two pairs of short ventral subanal cirri and a whorl of slender papillæ.

Parapodia of anterior region similar in general characters and setæ to atokous type of corresponding segments. Notopodia of first seven with basal half much enlarged, the distal portion remaining filiform, but not strongly bent. Neurocirri of first five setigerous segments also thickened at the base. All remaining parapodia are modified to the natatorial type, there being no caudal region, but the serrated notocirri continue to about XLV only, behind which they are smooth. The form of the complex lamellæ and lingulæ is best understood by reference to figure 18 (Pl. XV). All setæ are of the usual natatorial type and none of the peculiar setæ so characteristic of the middle notopodia of atokous individuals are present.

One specimen has the proboscis protruded and exhibits the paragnaths and jaws in characteristic arrangement.

Stations 4,355, San Diego Harbor, surface; 4,405, off San Clemente Island, 654-704 fathoms, green mud; 4,415, off Santa Barbara Island, 302-638 fathoms, green mud; 4,417, off Santa Barbara Island, 29 fathoms, fine yellow sand and rock; 4,420, off San Nicolas Island, 32-33 fathoms, fine gray sand; 4,421, same locality, 229-298 fathoms, gray mud and rock; 4,425, same locality, 1,100-1,084 fathoms, green mud, fine sand and Globigerina; 4,427, off Santa Cruz Island, 447-510 fathoms, black mud and rock; 4,431, off Santa Rosa Island, 38-41 fathoms, varied bottom; 4,496, off Santa Cruz Lighthouse, Monterey Bay, 10 fathoms, fine gray sand and rock; 4,531, off Point Pinos Lighthouse, 26-28 fathoms, fine gray sand, rock.

***Nereis paucidentata* Moore.**

*Nereis paucidentata* Moore. Proc. Acad. Nat. Sci. Phila., 1903, pp. 430, 431, Pl. XXIV, figs. 28-30.

A single small imperfect specimen from station 4,397, Lat. 33° 10' 15" N. Long. 121° 42' 15" W., 2,196 fathoms, gray mud. This is the first record of this species south of the Gulf of Georgia and the bathymetrical range is even more extended from 270 fathoms. The species is not uncommon in Alaskan waters.

***Nereis cyclurus* Harrington.**

*Nereis cyclurus* Harrington, Trans. N. Y. Acad. Sci., XVI, 1897, p. 214.

Two fine specimens showing faintly the annular bands of color. "Commensal in *Natica* shell with hermit crab."

Station 4,560, off Santa Cruz Lighthouse, Monterey Bay, 10-12 fathoms, fine gray sand and rock.

**Platynereis agassizi** (Ehlers). Pl. XV, fig. 19.

*Nereis agassizi* Ehlers, Die Borstenwürmer, 1868, pp. 542-546, Taf. XXIII, fig. 1.

Besides several atokous individuals, two of which (station 4,559) contain eggs, a large number of sexually mature epitokous examples were taken at station 4,355 by means of a surface electric light and dip-nets. Of the latter 83 were males and only 5 females. As the latter have never been described, a brief description is here added.

In general appearance they agree closely with the males, but average somewhat larger, from 21 to 33 mm. long. The two regions of the body of the two extremes measure, respectively, 5 and 16 mm. and 11 and 22 mm. long, and the segments number from 93 (28 + 65) to 131 (28 + 103), the anterior region of the female comprising, therefore, seven more segments than that of the male, which has 21. One female has only 27.

The color is generally pale and faded, but shows indications of transverse brown lines and posteriorly more distinct transverse rows of spots. Some of the specimens exhibit the same yellow color anteriorly as shown by the males, but usually much paler.

Prostomium almost exactly as in the males, the eyes, coalesced on each side, scarcely perceptibly smaller, the palps and tentacles turned almost as markedly ventrad. Peristomial cirri, so far as preserved, have the same proportions as in the males and, also, as in the males, are easily detached, so that many of them are wanting. One specimen, however, in which all are present, has two dorsal cirri nearly equal, both reaching XV, and the anterior ventral reaching to VI. There is a very short caudal region of ten or twelve segments with few or no swimming setæ and a short, tapering, tubular pygidium often constricted into two rings, quite different from that of the male in that it bears four cirriform papillæ in place of the whorl existing in the latter.

The first five (on the smallest specimen four) notocirri only are thickened and the slender distal end much less abruptly hooked than on the males. First four neuropodia similar to those of the males. Parapodia and setæ of anterior region also as in the males. Posterior parapodia differ from those of the males chiefly in the total absence from both notocirri and neurocirri of the sense organs which cause them to appear serrated, the cirri in the females being therefore quite smooth, simple and tapered.

Most of the specimens have shed the greater part of their eggs, but one remains filled with them as far forward as the tenth setigerous somite, inclusive, and a few have escaped into more anterior somites.

They crowd the basal part of the parapodia as well as the cœlom. The character of the mature eggs is shown in figure 19, Pl. XV.

Stations 4,346, off Point Loma Lighthouse, 46-50 fathoms, dark green mud and fine sand; 4,347, same locality, 55-58 fathoms, fine gray sand (both epitoke and atoke); 4,355, San Diego Harbor, surface (many epitokes); 4,420, off San Nicolas Island, 32-33 fathoms, fine gray sand; 4,422, same locality, 31-32 fathoms, gray sand and shells; 4,559, off Point Pinos Lighthouse, Monterey Bay, 8-22 fathoms, fine gray sand.

#### EUNICIDÆ.

**Eunice (Eriphyle) paloloides** Moore.

*Eunice (Eriphyle) paloloides* Moore, Proc. Acad. Nat. Sci. Phila., 1909, pp. 246-249, Pl. VII, figs. 5-7.

A much broken and macerated female specimen containing a few eggs in the posterior region. The sexual region begins at about segment CLXXXV. The tentacles and branchiæ are somewhat shorter than those of the type, but this probably results from the macerated condition of the specimen. In all other features studied it agrees with the type.

Station 4,420, off San Nicolas Island, 32-33 fathoms, fine gray sand.

**Eunice multipectinata** sp. nov. Pl. XV, figs. 20-23.

A fine, robust species which reaches a considerable size. The type is 205 mm. long with a maximum width of body of 7.5 mm. and between the setæ tips of 13 mm. Number of segments 181. Other complete specimens vary from 47 mm. long, 2 mm. wide, with 87 segments to 203 mm. long and 9 mm. wide. One 195 mm. long and 7 mm. wide has 177 segments. Incomplete specimens range all the way from 1 mm. to 11 mm. in width.

Prostomium in all except the smallest specimens retracted and deeply sunken into the peristomial collar to the tentacles; deeply incised and bilobed anteriorly to form the somewhat divergent, short, thick, bluntly rounded palps, slightly divided by a shallow transverse groove into a larger ventral and a smaller dorsal segment. Tentacles in a crowded transverse row, each with a small indistinct ceratophore; the styles more or less strongly and irregularly annulated or distinctly articulated; on the smaller specimens the median has about seven articulations and reaches to VII, the inner paired have but five articulations and reach to IV or V and the outer paired four articulations and reach III. Large specimens have shorter tentacles which have evidently worn away at the tips. Eyes always large and conspicuous, situated immediately behind the outer paired tentacles.

Peristomium very large, fully as long as the three succeeding segments and forming a prominent collar, into which the prostomium is retracted, most deeply in the larger specimens; on each side a shallow notch, below which it is produced forward more prominently to form a slightly crenulated lower lip with concave border. Somite II also apodous, not exceeding one-third length of peristomium with which it is coalesced at the sides. Nuchal cirri similar to cephalic tentacles but more slender, reaching to or nearly to the cephalic border of the prostomium. Metastomial podous segments well-defined, very regular, simple, 10-14 times as wide as long anteriorly, not over 8 times as wide as long posteriorly, strongly arched above, flattened, with neural furrow below. They increase in width gradually to about XL, then taper gently caudad.

Pygidium a short ring with a slight marginal thickening and bearing a pair of slender, little-tapered, stiff and smooth cirri as long as the last six segments and arising close together below the large anus. Immediately below and concealed by these is a second pair of minute and inconspicuous cirri.

Parapodia (Pl. XV, fig. 20) of simple form and exhibiting the changes in position and proportions usual in the genus. Notocirri four or five, or posteriorly (where the parapodia become shortened) even more, times as long as the neuropodia, slightly tapered and smooth or very slightly wrinkled, becoming much more slender posteriorly. Neurocirri prominent anteriorly, with thick, swollen, ovate bases and short, thick, cylindroid styles. Farther back the basal part is gradually reduced and finally becomes minute and the style becomes first short and conical and then slender and tapered, but always considerably exceeds the neuropodium in length.

Acicula all very dark brown and opaque except that the tips are often pale; the neuropodial three or anteriorly sometimes two, projecting from the acicular tubercle at the dorsal level of the fascicle of simple setæ. They are simple, tapering rods with rather acute points on anterior parapodia and blunt, often bent or somewhat knobbed ends on posterior parapodia where they become very stout. Notopodial acicula a fascicle of slender brown fibers passing into the base of the notocirrus in connection with a heavy mass of brown pigment.

With the exception of the stout crochets which are brown, the setæ are colorless or pale yellow. Three kinds occur on all segments. Simple, slender, wingless capillary setæ form a small dorsal tuft in connection with the acicula. Among the bases of the capillary setæ are delicate pectinate setæ with slightly curved ends provided with a few indistinct



teeth and a marginal mucron (Pl. XV, fig. 22). Most numerous are the compound setæ (fig. 21) which are arranged in about six rows, are pale yellow, with curved and distally thickened shafts and short, strongly hooked, and bidentate appendages with a delicate guard finely denticulated on the margin. The last become larger caudad. Beginning at about XXVII two (sometimes one) stout crochets appear projecting prominently obliquely from the neuropodium ventral to the compound setæ; they are slightly curved, with stout principal tooth and smaller more distal accessory tooth and provided with a split guard (fig. 23).

Branchiæ strictly unilateral pectinate throughout (Pl. XV, fig. 20), consisting of a tapered main stem arising from the base of the neurocirrus on its dorsal side and curving gently up the sides of the body, but remaining erect, leaving the dorsum uncovered; filaments arising nearly at right angles to the stem in a close rank and lying nearly parallel, slender, the longest not exceeding two-thirds the length of the notocirrus and the main trunk, exclusive of the terminal filament into which it is prolonged, not much greater. On the type the gills begin on somite IX with seven filaments, attain the maximum of twelve filaments and retain this number, with occasionally one or two more for a great many segments, then undergo gradual reduction posteriorly, the gill on the fourth preanal segment still being trifid.

With few exceptions the gills of all specimens begin on IX, the only departures being three specimens, on two of which the first on one side occurs on VIII and on another on X. The number of filaments varies greatly, increasing with the size of the specimen. The smallest example (1 mm. wide) has the first gill simple and most of the others bifid. A complete specimen, 47 mm. long and 2 mm. wide with 87 segments, bears gills on all podous segments beginning with IX, the first and the last two consisting of a single filament each and the maximum number of filaments being three. One 140 mm. long and 4 mm. wide lacks gills on the last four segments, the maximum number of filaments is seven and most of the gills caudad of the middle of the body are trifid. Another, 195 mm. long and 7 mm. wide, with 177 segments, has trifid gills on IX of one side, X of the other and attains a maximum of twelve or thirteen filaments, with the last three segments abbranchiate. The largest complete specimen is 203 mm. long and 9 mm. wide and bears a small gill of two filaments on one side of VIII, the maximum number of filaments being fourteen and the last gill on the fourth preanal segment. Bifid filaments occur frequently.

Jaws (described from a cotype, station 4,431) hard and firm. Mandibles with stout, divergent, nearly black stems joined only slightly by an anterior isthmus; masticatory plates hard, white, oval, with smooth, entire anterior border. Maxillæ black or nearly so. Carriers of forceps-jaws nearly as wide as long, broadly rounded behind; the forceps of the usual falcate form; II very large and stout with five large teeth and one small one on each side; III on the right side is a long narrow piece with eleven teeth diminishing in size from before backward and is paired with two pieces on the left side with four and eight teeth, respectively; IV bears a single prominent tooth on each side; V is a small toothless plate. Two other specimens dissected agree in all essentials, the teeth being generally tipped with white and the border of the mandible in one case tridentate.

Color of the full-grown specimens pearl or gray with a beautiful and delicate iridescence. Two of the larger specimens have the dorsum finely mottled with brown. The smallest examples are more distinctively colored: one is pale brown above with an obscure white zone on IV and V; another (the smallest) has the first three segments almost solidly orange-brown, IV and V pure opalescent white and several succeeding segments annulated with brown and white.

Stations 4,312, off Point Loma Lighthouse, vicinity of San Diego, 95-135 fathoms, fine gray sand and rock; 4,373, same locality, 95-225 fathoms, green mud, sand and rock; 4,377 (Type), same locality, 127-299 fathoms, green mud and sand; 4,420, off San Nicolas Island, 32-33 fathoms, fine gray sand; 4,431, off Santa Rosa Island, 38-41 fathoms, varied bottom; 4,463, off Point Pinos Lighthouse, 285-357 fathoms, green mud; 4,532, same locality, 30 fathoms, gray sand and rock.

This species is related to *E. bilobata* Treadwell, but is readily distinguished by several characters, especially by the notably smaller number of gill filaments. The type of *E. bilobata* is 5.5 mm. wide and the first gill (on IX) has nine filaments, the maximum reaching eighteen. A specimen of *E. multipectinata* of the same size has only two filaments on the first gill and a maximum of seven filaments.

Other species having pectinate gills for the entire length which have been reported from the Pacific Ocean are *E. antennata* Savigny, *E. micropriion* v. Marenzeller and *E. flavo-fasciata* Grube. All of these have the gills beginning farther forward and differ in other respects also.

***Eunice hawaiiensis* Treadwell?**

*Eunice hawaiiensis* Treadwell, Bull. U. S. Fish Comm., XXIII (1906), Pl. III, pp. 1166, 1167, figs. 42-44.

The solitary incomplete example referred to here, while differing considerably from Treadwell's description, is certainly very closely related to, if not identical with, *E. hawaiiensis*. It consists of 122 anterior segments having a length of 76 mm. and a width without parapodia of 5.5 mm. and with them, but excluding setæ, of 8.5 mm.

The prostomium with its tentacles, the parapodia, setæ (of which, however, Treadwell's figure does not show a full profile view), and maxillæ are practically identical with those of *E. hawaiiensis*. The branchiæ, however, are fewer and much less complex than those of the type. They have the following distribution and number of filaments on the right side, the left being almost identical: 1 filament somite V, 2 filaments somite VIII, 5 on IX, 9 on X, 13 on XII, 15 on XV, 19 on XX, 15 on XXVI, 16 on XXXV, 8 on XL, 5 on XLII, 2 on XLIII and 1 on XLIV. Where best developed, from XV to XXX, the gills are very large with numerous long, parallel filaments equalling about one-third the body width. Although closely resembling the gills of *E. hawaiiensis*, the stems are always gently curved, never abruptly bent. The first three consist of the main trunks only. The type of *E. hawaiiensis* is larger, measuring 7 mm. in body width and has the gills beginning on IV with three filaments and continuing to beyond L, and when best developed possessing as many as thirty filaments. This is a greater difference than one would expect in two individuals of the same species differing no more in size than do these.

The hard, white masticatory plates of the mandibles, in addition to the large lateral tooth, bear three small teeth near the median line.

*Eunice congesta* v. Marenzeller may be mentioned as another closely related Pacific species.

Station 4,537, off Point Pinos Lighthouse, Monterey Bay, 1,062 fathoms, hard sand and mud.

***Marphysa conferta* sp. nov. Pl. XVI, figs. 29-34.**

Known from a single specimen 24 mm. long and 1.9 mm. wide between tips of parapodia with 57 segments and a regeneration cone of about a dozen indistinct segments.

Prostomium (Pl. XVI, fig. 29) large, nearly as wide as the peristomium, suborbicular but bent downward so that in dorsal view it is foreshortened and appears much wider than long, depressed, with an anterior notch that is the termination of a ventral groove that slightly divides it into somewhat swollen rounded halves. Eyes one pair,

large, conspicuous, brown, situated close to the posterior border immediately behind the lateral tentacles. Tentacles five, arising along a slightly curved transverse line near the posterior end of the prostomium, but passing in front of the eyes laterally. All slightly fusiform, tapered to distal end and transversely wrinkled or subarticulated, the median about one and one-third times the length of the prostomium, the others successively somewhat shorter.

Peristomium a simple, regularly cylindrical, smooth, apodous ring with a slight median ventral notch on the lip and no trace of nuchal cirri. Somite II scarcely more than one-half as long as I, but otherwise similar. The remainder of the body is terete, of nearly uniform diameter except that the posterior portion is somewhat enlarged and distended with ova. The segments become shorter to the branchial region, where they are about four and one-half times as wide as long; posterior to this the length again increases until at the posterior end they are only twice as wide as long. With the fourth (Pl. XVI, fig. 29) a small ring separates at the anterior end of each segment and increases until in the post-branchial region it forms a regular propodal annulus. Pygidium at the end of the regeneration cone a short tube bearing one cirrus about equal to one-fourth the body width and another half as long as the first.

Parapodia (Pl. XVI, figs. 30, 31) strictly lateral and in the probranchial and branchial regions prominent and outstanding, becoming smaller in the postbranchial region, strictly uniramous, there being no trace of a notopodium. Anterior parapodia consist of a low, rounded, slightly compressed setigerous tubercle, behind which is a compressed postsetal lip at the base as deep as the setigerous lobe, while its bluntly ending dorsal part is prolonged to about twice the length of the base. The notocirrus arises just above the foot and is about twice its length, somewhat enlarged at the base, slender and tapering distally and marked with obscure annular furrows. The neurocirrus has a thick, swollen base broadly attached to the ventral face of the neuropodium and bearing a small papilliform distal piece which is bent more or less ventrad. Posterior to the branchial region the parapodia and all of their parts become gradually smaller. The neuropodia become low, compressed cones (fig. 31), the apex of which is formed by the acicular process, while the postsetal lip becomes low and inconspicuous. The basal part of the neurocirri is much reduced, leaving only the short, bluntly rounded cirrus which reaches to the end of the acicular process. The notocirrus while undergoing reduction in size retains its characteristic form and proportions, having a

basal enlargement and a slender style about three times as long as the foot.

Neuropodial acicula two or three simple, straight, tapered rods with the ends pale and the middle brown or black. Posteriorly there is only one of these, the distal end of which projects freely. No notopodial acicula.

Branchiæ (Pl. XVI, fig. 30) remarkable for their large size and restriction to nine segments (X–XVIII inclusive). The first on X has five fully developed filaments and the number on the others varies from five to seven. Each consists of a short, stout, tapered trunk arising from the dorsal side of the base of the notocirrus and curving dorsad over the back, its distal end abruptly bent to form the last filament, parallel and nearly equal to the others, which are slender and tapered and nearly equal in length to the notocirrus with which the ventralmost is coalesced at the base. The largest meet across the dorsum.

Setæ of four kinds, all but the crochets colorless. Compound setæ (fig. 32) form a dense subacicular fascicle of several rows, very numerous anteriorly, fewer behind. The shafts are slender, curved, with the ends enlarged, oblique and bearing a deep cleft or socket with finely serrated borders. Appendages loosely attached, tapered from the basal enlargement to the bidentate tip, remarkable for the length and wide separation of the teeth; detached front border finely denticulated or striated and continued into the delicate hood. Supra-acicular fascicle composed of a tuft of delicate simple capillary setæ, some of which are prolonged as far as the end of the notocirrus and associated with these on postbranchial parapodia a few very delicate pectinate setæ with 16 or 18 short mucronate teeth and one margin bearing a slender filament (fig. 33). Posterior parapodia bear a single ventral crochet of a yellow color and having the end bidentate and hooded (fig. 34).

Practically colorless and lacking notable iridescence, only a slight greenish shimmer anteriorly. Jaws not dissected.

The type, a female filled with ova, comes from station 4,431, off Brockway Point, Santa Rosa Island, 38–40 fathoms, coarse gray sand, yellow mud and rocks.

#### ONUPHIDÆ.

The large number of species representing this family is noteworthy, there being in the collection five species of *Nothria*, three of *Onuphis*, one of *Diopatra* and two of *Hyalinæcia*—no less than eleven in all.

Within areas of similar size and under similar conditions of collecting one usually finds not over four or five species. Three species were found each at station 4,387, in deep water off the Gulf of Santa Catalina, and 4,510, in Monterey Bay. With few exceptions, they occurred on muddy bottoms.

**Nothria iridescens** Johnson.

*Nothria iridescens* Johnson, Proc. Bos. Soc. Nat. Hist., XXIX, p. 408, Pl. 8, figs. 86, 87; Pl. 9, figs. 88-92.

The gills of this species begin on the first parapodium. Two points in Johnson's description require modification after a study of the large number of specimens in this collection. The biarticulate style of the posterior paired tentacles is accidental and inconstant. Similar breaks may occur on any of the styles; there may be several on one style or be asymmetrical on the two styles of a pair or, as is most usual, altogether absent. Neurocirri do not disappear on V, but remain quite prominent, though short and thick, to VII, and their thickened bases continue as glandular swellings to the middle of the body as in many other species of the genus. The posterior paired tentacles, although quite variable in length, seem always to exceed the median tentacle. The color is quite variable, but usually more or less blotched with deep purple and brightly iridescent anteriorly.

A tube of average size is 190 mm. long and 5.5 mm. in diameter, the outer end being slightly larger than the inner. The larger end is composed almost entirely of a very fragile wall of fine silt nearly 2 mm. thick and lacks the tough membranous lining that extends through the remainder of the tube.

This species occurs generally throughout the region covered by this report and was taken in abundance at stations 4,462, 4,485, 4,508, 4,510, 4,523, 4,525 and 4,526.

Stations 4,322, Soledad Hill, Point La Jolla, vicinity of San Diego, 110-199 fathoms, soft green mud; 4,339, off Point Loma Lighthouse, vicinity of San Diego, 289-369 fathoms, green mud; 4,433, off Santa Rosa Island, 243-265 fathoms, green mud; 4,436, off San Miguel Island, 264-271 fathoms, green mud; and the following stations in Monterey Bay: 4,446, 4,457, 4,461, 4,462, 4,463, 4,464, 4,475, 4,482, 4,485, 4,508, 4,510, 4,522, 4,523, 4,524, 4,525, 4,526, 5,428 at depths varying from 36 to 357 fathoms, except in the case of the last station where the depth is recorded as 766-800 fathoms. The bottoms were muddy, usually "soft green mud," except at station 4,463, which was rocky and yielded a single specimen, and at station 4,522, which yielded ten specimens and is recorded as of gray sand and shells, though evidently adjoining a bed of green mud (station 4,523, etc.).

**Nothria geophiliformis** Moore.

*Nothria geophiliformis* Moore, Proc. Acad. Nat. Sci. Phila., 1903, pp. 445-448, Pl. XXV, figs. 57-59.

Gills may begin on either V or VI, usually the latter. A young specimen has a pair of minute eye specks. The small size of this species has probably caused it to be overlooked at some stations. The anterior articulated crochets differ strikingly from those of *N. pallida*.

Stations 4,445, off Point Pinos Lighthouse, Monterey Bay, 60-66 fathoms, green mud; 4,480, off Santa Cruz Lighthouse, Monterey Bay, 53-76 fathoms, dark green mud and sand; 4,510, off Point Pinos Lighthouse, 91-156, gray mud.

**Nothria pallida** sp. nov. Pl. XV, figs. 24-28; pl. XVI, 35-37.

A moderately elongated species, terete anteriorly, depressed for most of the length. The type—an incomplete specimen with the caudal end regenerating—consists of 166 segments and is 82 mm. long with a maximum body width of 4 mm. and a depth of 2.7 mm. at the end of the anterior third. A complete specimen 62 mm. long and 2.8 mm. wide has 266 segments. Another broken specimen has an aggregate length of 124 mm. and 290 segments.

Prostomium relatively larger than in *N. geophiliformis*, quadrate orbicular in outline, slightly wider than long, with the greatest width at the level of the posterior paired tentacles. No distinct eyes, though several obscure dusky spots appear on the prostomium. Frontal tentacles nearly in contact at the base, arising on extreme anterior border of prostomium, divergent, cylindroid with a lateral emargination about which they are bent into a bean-like shape; about twice as long as thick and one-half as long as the prostomium. Anterior or outer paired tentacles barely reaching to III, the annulated ceratophore of thirteen rings and a short, non-annulated end, about one and one-fourth times as long as the short, smooth conical style. Posterior lateral tentacles reaching XVI or XVII, the ceratophores nearly as long as the entire anterior tentacles and composed of seventeen rings and a smooth end-piece; styles flagelliform, much more slender than ceratophores and three and one-half times as long. Median tentacle reaching to IX, similar to posterior paired tentacles, but ceratophores only half as long with nine or ten annuli. A small specimen has the styles of the anterior paired tentacles nearly equal to the ceratophores and the median and posterior paired tentacles shorter than on the type, the latter reaching to XII only. Palps situated immediately in front of mouth, separated by a narrow cleft only, thick, quadrate, and divergent, about twice the size of the frontal tentacles.

Peristomium not longer than prostomium; continuing its regular outline and widening posteriorly; deeply cleft below for mouth and bearing the wide, bilobed, hammer-shaped, posterior lip. Nuchal tentacles arising from its extreme anterior border, separated by slightly more than their length and reaching extreme anterior endoprostomium. Anterior region of body slender and terete, the segments about as long as wide and not much wider anteriorly than posteriorly. Beyond V the segments become gradually shorter, wider and more depressed until in the middle region they are very regularly about eight times as wide as long. Farther back they become gradually narrower and less depressed without change in length till near the pygidium. Pygidium short, cylindroid, abruptly truncated, bearing two pairs of slender divergent cirri, of which the dorsal is twice the length of the ventral and one-half the body width.

Parapodia (Pl. XV, figs. 24, 25, and Pl. XVI, fig. 35) exhibit the usual characteristics of the genus. The first five are widely separated and modified, but gradually become less so from before backward. The three cirriform processes (figs. 24 and 25) are present and moderately slender and elongated, the notocirrus the longest of the three and reaching the middle of the preceding foot in each case, the neurocirrus and the middle cirrus or postsetal lobe each from one-half to two-thirds as long on the different parapodia, the latter the stouter and flattened at the base. Just before and after the gills appear, the notocirrus exhibits a conspicuous constriction and distortion near the base. After the fifth parapodium the neurocirrus becomes rapidly reduced to an opaque glandular ridge below the base of the parapodium which for a few segments bears at its lateral end a short blunt papilla which recedes into the ridge in the course of three or four segments. The postsetal lobe becomes reduced rapidly and completely; beginning with the sixth foot, it becomes shorter and blunt and continues to be changed until at the eleventh it becomes a small, blunt, rounded papilla lying ventral to the setæ and almost replacing the here obsolete neurocirrus, but postacicular instead of preacicular. Farther back (fig. 35) it totally disappears. The notocirrus remains well-developed for the entire length, but undergoes gradual reduction in size after the appearance of the branchiæ, appearing upon the largest of these as a much smaller lateral process. The neuropodium becomes rapidly shorter and simplified as in other species.

Branchiæ (Pl. XVI, fig. 35) simple throughout, the first appearing in connection with the fourth foot (V) or more rarely with the third on IV, in the latter case being usually quite small. They appear as



the direct continuation of the base of the notocirrus, which they displace ventrally or toward the neuropodium. The first is always much more slender than the notocirrus, but nearly as long. By somite X the gill is three times as long as the notocirrus, and when, on middle segments, its maximum size is reached is fully four times as long and reaches well beyond the mid-dorsal line except on one specimen, on which they are strongly contracted. All of the gills, which continue nearly to the caudal end, are coarse round filaments apparently not at all ligulate and contain two large longitudinal blood-vessels connected by a large number of semiannular transverse vessels.

Neuropodial acicular three or four stout, tapered rods with mucronate tips projecting freely beyond the surface antero-ventral to the curved series of capillary setæ from which they are not sharply distinguished. Notopodial acicula a fascicle of a few very slender and delicate fibers passing through the notopodial base and far into the notocirrus.

Setæ are of five forms, all but the yellow posterior crochets being colorless. The first five neuropodia bear a nearly complete circle enclosing the acicula, of semi-articulated, tridentate, guarded crochets (Pl. XV, fig. 26) and simple capillary setæ differing little from the acicula save only in their longer projecting points. The latter increase in number and in size and in parapodia immediately following the fifth (VI) replace the crochets. In the course of ten or twelve segments they gradually disappear. All parapodia, beginning with the sixth, bear a curved fascicle dorsal to the postacicular lobe of delicate, nearly straight, capillary setæ which, on anterior segments, are provided with a narrow limbus not discernible posteriorly. Among the bases of these are very delicate setæ ending in gouge-shaped expansions bearing eighteen or twenty regular mucronate teeth (fig. 27). Beginning at about XVII two large and stout crochets appear antero-ventral to the acicular papilla; their shafts are slightly curved and distally thickened and the little projecting ends bidentate and enclosed between a pair of guards (fig. 28).

Jaws described from a single dissection of a cotype (station 4,401). Mandibles (Pl. XVI, fig. 36) pale brown with pure white masticatory plates, soft, the two halves only very slightly joined by the bases of the masticatory plates, the long slender stems or carriers widely separated and of nearly equal width throughout. Masticatory plates white with a black trifid spot near the base of each, narrowly ovate quadrilateral with obscurely bidentate end. Maxillæ (fig. 37) rather soft, pale brown with certain very dark lines and thickenings as shown

in the figure. Carriers of forceps jaws (I) only slightly united, widest at the middle, their posterior ends separated and pointed; forceps stout at base, the ends acute and strongly hooked. Large dentinal plates (II) stout and broad, the right with nine nearly equal stout teeth, the left with six teeth, of which the first is enlarged and separated from the others by a considerable gap. Left unpaired plate (IIa) with seven or eight teeth. Anterior pieces (III) with a narrow, curved, toothed ridge and a large flaring basal plate or wing, the left six- or seven-toothed, the right larger, with eight teeth. Small accessory jaws (IV) triangular, each bearing a single tooth.

Except for a small brown spot at the base of each notocirrus and smaller ones on the bases of the tentacles, the specimens are colorless.

The anterior ten or twelve segments of every specimen are strongly bent upwards so that the head is usually quite reversed.

Stations 4,352 (Type), off Point Loma Lighthouse, vicinity of San Diego Bay, 549-585 fathoms, green mud; 4,400, Lat. 32° 50' 20" N., Long. 118° 03' 30" W., 590-507 fathoms, green mud; 4,401, Lat. 32° 52' 40" N., 118° 13' 40" W., 448-468 fathoms, green mud, black sand; 4,415, off Santa Barbara Island, 302-638 fathoms, green mud.

*Nothria* sp.? Pl. XVI, figs. 38-40.

The anterior end of a rather small *Nothria* 1.6 mm. wide, probably representing another undescribed species. It has much of the aspect of *N. geophiliformis* and the setæ resemble those of that species, from all typical examples of which it differs, however, in the first appearance of the gills on VII. The cephalic tentacles are peculiar and may be abnormal. The median just equals the anterior or outer paired and its style is about two-fifths that of the posterior paired. The frontal tentacles are shorter than their diameter. All cephalic ceratophores are short and 5- or 6-annulate. No eyes. Nuchal cirri very short, only one-third or one-fourth of the distance separating them. Gills begin abruptly on VII, resemble those of *N. holobranchia* and in their full development reach to the opposite side. Jaws not dissected.

Taken from a simple mud tube from station 4,387, Lat. 32° 32' 40" N., Long. 118° 04' 20" W., 1,059 fathoms, green mud.

*Nothria hiatidentata* sp. nov. Pls. XVI, XVII, figs. 41-50.

A very interesting species based on two specimens found in a jar of *Hyalinæcia tubicola*, to which species this bears a remarkably close superficial resemblance. Indeed, in most characters except the presence of nuchal cirri this species resembles *Hyalinæcia* more closely than ordinary *Nothria*. It is a noteworthy case of associative resemblance.

The type is a complete example of 94 segments, 112 mm. long, with a maximum body width at XXV of 4.8 mm. and a depth of 4 mm. Prostomium (Pl. XVI, fig. 41) in the strongly up-bent position in which it occurs in both specimens nearly circular, the seven tentacles radiating very regularly about its margin and as usual increasing in length from before caudad. Frontal tentacles in contact medially on the extreme anterior border of the prostomium from which they are scarcely delimited, little divergent, nearly two-thirds as long as the prostomium, short ellipsoidal and slightly bilobate from a shallow lateral furrow. Probably the styles of none of the dorsal tentacles are quite complete, the ends of all being more or less worn and ragged. The ceratophores of all are short, scarcely longer than thick and divided into three or four annuli. The styles increase in both length and diameter from before backward, the anterior paired reaching to II, the posterior paired to XII or XIII and the median to XV. Palpi large, subglobose, slightly bilobed processes bounding the mouth in front, in contact medially and projecting ventrad and laterally beyond the sides of the prostomium.

Peristomium reduced, scarcely half as long as the prostomium and not much wider. Nuchal cirri (fig. 41) arising slightly behind anterior border of peristomium in line with lateral border of base of posterior lateral tentacles, slender, tapered, not quite reaching base of one of opposite side. Posterior lip somewhat bilobed, furrowed, its anterolateral margins continuous with mandibular cushions and not projecting freely as in many species. Somite II much enlarged, more than twice as long as I and nearly twice as wide, strongly convex and rising beyond I on all sides and embracing it completely laterally. Anterior region of body stout, not slender as in many species; III and IV rapidly reduced in length, V about normal; its width about six times length. These proportions are maintained throughout the middle region, but the width gradually decreases posteriorly until it becomes only three times the length. Dorsum very strongly arched, venter flat with neural groove. Body walls firm and muscular anteriorly, softer with translucent walls posteriorly. Caudal end tapered rather rapidly to a short tubular pygidium with expanded rim bearing a pair of very slender subanal cirri as long as the last eleven segments and one and one-third times the greatest body width.

Parapodia of anterior end much like those of *Hyalinæcia* (Pl. XVI, figs. 42, 43). The first (fig. 41) much enlarged, most modified and strongly bent forward at sides of prostomium to the level of its anterior border, cylindroid or subconical and truncate, much and deeply fur-

rowed, terminating in a low, rounded acicular process and two broad, flat lips, the post-acicular one being much the longer and truncate distally. The short, simple notocirrus arises about the middle of its dorsal face and barely reaches the distal end of the neuropodium. Neurocirrus arises on ventral side close to mouth and fails to reach the bases of the setæ. Second parapodium (III) (fig. 42) is similar but much smaller and both the post-acicular process (middle cirrus) and notocirrus are much more slender and elongated, while the neurocirrus is enlarged and bluntly conical. The third foot is of more normal size and position and the notocirrus is still longer, reaching beyond the postacicular lobe. But the chief change affects the neurocirrus, which is no longer truly cirriform, but merely a small, rounded, cylindrical papillæ. The fourth parapodium (fig. 43) differs only in the complete suppression of the neurocirrus. After the fourth (somite V) the neuropodia are gradually reduced in size until they become low, compressed cones (fig. 44). The maximum size of the post-acicular lobe is attained at about VII or VIII, after which it undergoes gradual reduction, being still distinct at XV but obsolete at XXX. The notocirrus retains its length longer, at its maximum reaching about half-way to the middle line and exhibiting but little change until after the appearance of the gills, when it becomes rapidly reduced to a slender filament about one-third as long as the gill (fig. 44). Behind IV the neurocirri become small, rounded glandular elevations which gradually become smaller and finally disappear.

Gills begin on XIV, though a small prophetic papillæ occurs on one side of XIII of one specimen. They arise at a brown vascular knot on the dorsal side of the base of the notopodium, which, however, is not so abruptly displaced ventrad as in *Nothria pallida*, though, when the cirrus reaches its greatest reduction, it appears as little more than a lateral process of the gill (fig. 44). From the first they equal the notocirrus in length and seldom reach more than half-way to the middle line. They have the usual form and structure but, unlike those of *N. iridescens* and other species, become little flattened posteriorly.

Neuropodial acicula four or five, stout, slightly curved and tapered, the simply pointed tip apparently not reaching beyond the surface on anterior parapodia. Farther back there are three with abruptly tapered, acute, curved and often bent tips exposed for a short distance. There are no evident notopodial acicula.

Setæ are of four kinds. Large setæ on the anterior modified segments mostly broken, but several that are intact (Pl. XVI, fig. 45) are simple spines with the ends worn smooth as in *Hyalinaccia*. A

single newly erupted smaller one on III (fig. 46) shows that they are bidentate and guarded at the tip, but apparently not articulated. Limbate setæ and pectinate setæ (fig. 47) begin on the second foot, on which the type specimen bears in a dorsal fascicle several of the former and one of the latter. Beginning with the fourth foot and continuing to the caudal end there are both dorsal and ventral small fascicles of limbate setæ. They have rather long stems and gently sigmoid, tapered and very acute ends bearing lanceolate, bilimbate blades. They become longer posteriorly. Delicate colorless pectinate setæ (Pl. XVI, fig. 47) occur among the bases of the dorsal limbate setæ from III to the caudal end and, except on the first two or three parapodia, form a dense cluster. The ends appear to be funnel-form with about one-third of the circle cut out and the border striated and finely denticulated. Ventral crochets begin on V, at first single and slender, but after about XV there are two or three. Two very stout yellow ones (fig. 48) are characteristic of the middle region. These have fibrous cores and slightly curved shafts, swelling distally, then rather abruptly contracted to the small head which is terminated by two rather long processes placed at nearly a right angle to the shaft and enclosed in a pair of narrow, subtriangular guards. The terminal teeth become shorter on anterior segments.

Jaws described from the cotype. Mandibles chiefly dark brown except the masticatory plates which are white with two or three very dark brown lines across the basal part (Pl. XVII, fig. 49). The two halves are very lightly united; the stems of nearly uniform width, with slightly expanded distal ends grooved to bear the masticatory plates which are elliptical with irregularly crenulated free margins. Maxillæ (fig. 50) massive, dark brown, hard. Carriers of forceps jaws very broad in posterior half, about one and one-fourth times length, the posterior border broadly rounded. Forceps rather long and slender, strongly hooked with acute tips. Maxilla II, left outer plate with nine teeth, of which the first is very large and widely separated from the second very small tooth by a wide bay fitting the anterior end of the left inner plate, which bears nine regular stout teeth; right plate very large with ten large, somewhat hooked teeth. Maxillæ III, narrow curved pieces, the left bearing ten, the right thirteen teeth. Maxillæ IV, small plates bearing a single tooth on each side.

Color all faded out with the exception of small brown spots at the base of the gills.

Described from two specimens (of which the cotype is filled with sperm balls) both from station 4,387, off San Diego, Lat. 32° 32' 40" N., Long. 118° 04' 20" W., 1,059 fathoms, green mud.

*Onuphis parva* sp. nov. Pl. XVII, figs. 51-57, and Pl. XVIII, figs. 98, 99.

A small, slender species of linear form, the type measuring 36 mm. long and, exclusive of the parapodia, about .6 mm. wide, with 104 segments. A large number of specimens are of similar size and only a very few larger, the maximum being about 45 mm. long and .9 mm. wide. Sexual maturity is attained at a length of 30 mm.

Prostomium longer than usual, about one and one-quarter times as long as wide, elliptical in outline. Frontal tentacles on ventro-anterior border, nearly their length apart, divergent, ovate in outline with a constricted pedicle, their length about two-fifths prostomium. Anterior paired tentacles on antero-lateral border, barely reaching IV; ceratophore about one-third style, 4-annulate. Posterior paired tentacles on dorsal face close to lateral margins and slightly in advance of middle, reaching IX or X; ceratophore slightly longer than those of anterior pair, its basal half of three distinct rings, the distal half not distinctly annulated. Median tentacle arising at almost exact center of prostomium, constantly slightly shorter than posterior paired tentacles, reaching only to VIII or middle of VII, its ceratophore similar to that of posterior pair. Eyes situated immediately caudad of base of posterior paired tentacles, usually two minute black specks (sometimes coalesced into one) on each side. Palps rather prominent, ovate lobes on ventral face of prostomium, projecting slightly beyond its margins.

Peristomium similar in size and proportions to immediately following segments, shortest above, where it is about one-half prostomium, the latter being much more extensively exposed than in most species. Nuchal cirri widely separated on extreme anterior border of peristomium, short conical, barely reaching to middle line or posterior border of peristomium. Somite II neither wider nor longer than succeeding segments, not embracing peristomium and its parapodia, not obviously enlarged nor strongly bent forward. The first three or four podous segments differ from the others only in having the walls somewhat firmer, the integuments more pigmented, in being more terete and in having the parapodia more ventral in position. Middle and posterior segments strongly depressed, with the parapodia and especially the gills carried high, the parapodial area thick and glandular and the dorsal and ventral field flat and translucent. They are remarkably uniform in size, but taper gradually in the posterior half.

Pygidium tubular with an obliquely truncate end having a thickened border and at the produced ventral margin a cluster of two pairs of very slender and delicate anal cirri, the dorsal about four times as long as the ventral and equal to the last seven segments.

Parapodia all small and little prominent, even the first, although slightly enlarged and somewhat modified as in other species, presenting none of the extreme modifications so often exhibited. The first has a low presetal and a much enlarged postsetal lip, the latter being broad and flat at the base. Both cirri arise far out and the notocirrus is tapered and reaches much beyond the end of the postsetal lobe; neurocirrus bluntly truncated and falls short of the tip of the latter. The second (Pl. XVII, fig. 51) and third differ chiefly in the shorter base, shorter and broader postsetal lobe, shorter neurocirrus and successively more dorsal position. With the fourth (fig. 52) the parapodia have about reached the dorsal position characteristic of this species and the neurocirrus has been lost in a low rounded infrapodal glandular swelling. The postsetal lobe continues to shrink, and by XV is quite inconspicuous and little longer than the presetal lip; the neuropodium becomes a broad, low, conical eminence (fig. 53) and the notocirrus, although gradually reduced in size, remains well-developed to the caudal end.

Branchiæ begin on the fourth foot (somite V) of the type, but although this is the most frequent beginning small simple ones may be detected on IV or even III of some specimens; more rarely the first occurs on VI. The first gill is simple or bifilar, the former being especially the case when they have the more anterior origin. The single filament (Pl. XVII, fig. 52) is erect and forms the main trunk of the gill, along the lateral side of which the secondary filaments arise on more posterior gills. The first few gills are no longer than the notocirri, but they increase as the latter diminish in size, the main stems often reaching to or beyond the dorsimeson. Characteristically, they are erect or semi-erect and pectinate (fig. 53) with a maximum of about seven filaments, though the number varies from five to nine according to the size of the specimen. On the type the last gill occurs on XXXVII. A cotype, on which the gills are more fully extended, has the gills arranged as follows: 3 filaments on VIII, 4 on XII, 5 on XIV, 6 on XV, 7 on XX-XXVII, 6 on XXVIII and XXIX, 5 on XXX, 4 on XXXI and XXXII, 3 on XXXIII, 2 on XXXIV, and one on XXXVI. This is about the usual distribution.

Neuropodial acicula usually four, little tapered until near the end where they taper abruptly to a slender exposed mucron, the longer of which project nearly to the border of the postsetal lobe. Farther back they become fewer. Notopodial acicula delicate fibers passing far into the notocirri.

Setæ all colorless. Setæ of first parapodium (Pl. XVII, fig. 54)

exclusively (except perhaps the dorsalmost) semicompound, bidentate and guarded crochets with the articulation very imperfect and the guards much prolonged and very acute. None of these setæ is much enlarged and the dorsalmost is very slender and acute and may lack the hooked and bifid tip. The second and third parapodia have a few similar setæ in the anterior part of the fascicles, together with a few simple acute setæ in the dorsal part. On the fourth foot all setæ are of the latter type. Toward the distal end they become somewhat enlarged and minutely pilose, but not truly limbate and then taper to an acute tip. On the fourth parapodium there are only seven of these setæ, four being anterior and three dorsal, the latter more slender. Simple setæ of this type appear on all subsequent parapodia, but after a few segments are limited to a small dorsal fascicle of two to four and gradually become more slender and elongated toward the caudal end. Pectinate setæ (fig. 55) first detected on IX and present on all following segments as a small dorsal tuft of three to six. They are extremely delicate and have slightly curved asymmetrically expanded ends with the margin distinctly denticulated. Two large ventral crochets (fig. 56) appear on X, but become larger and more exposed farther back. They are peculiar in the length of the beak and small size of the accessory tooth and the somewhat unusual width of the guards. Toward the caudal end they become much smaller and one has the teeth reduced and the other more or less straightened out and the guards are frequently absent (fig. 57).

Jaws (Pl. XVIII, figs. 98-99) pale brown or yellow, translucent, soft, and flexible. Mandibles very delicate, the carriers slender, widening very little distally, feebly united, the masticatory plate narrowly elliptical, prolonged forward, a small tooth on the medial side. Maxillæ (fig. 99) with acute, strongly hooked forceps jaws, the carriers about two-thirds as wide as long, each half prolonged into a slender posterior process. Maxillæ II broad plates, the left outer with eight or nine teeth, the inner with seven or eight, the right with nine or ten larger teeth; III, left five or six teeth, right seven or eight teeth; IV rudimentary, edentulous.

Nearly all of those examined are practically colorless, the anterior end more opaque and iridescent. Some examples from station 4,454 have the cephalic appendages dark or black and conspicuous quadrate blotches of black scattered over all parts of the body both dorsally and ventrally and on parts enclosed by the tubes as well as parts exposed.

Tubes generally about 45 mm. long and 2 mm. to 2.3 mm. in diameter, tapering off at one end to a thin membranous portion. The thicker



portions are composed mainly of fine silt, but sometimes with a few sand grains or minute pebbles.

This appears to be an abundant species, and were it not for its small size would doubtless have been collected at many more stations. It was especially abundant at stations 4,467 and 4,468, where several hundred tubes were taken, and at 4,475, where about fifty were obtained.

Stations 4,445, off Point Pinos Lighthouse, Monterey Bay, 60-66 fathoms, green mud; 4,446, same locality, 52-59 fathoms, green mud (type); 4,452, 4,453, 4,454, same locality, 49-71 fathoms, green mud and sand; 4,457, same locality, 40-46 fathoms, dark green mud; 4,464, same locality, 36-51 fathoms, soft dark gray mud; 4,467, off Santa Cruz Lighthouse, Monterey Bay, 51-54 fathoms, soft dark green mud; 4,468, same locality, fine sand; 4,475, off Point Pinos Lighthouse, 58-142 fathoms, soft green mud; 4,480, off Santa Cruz Lighthouse, 53-76 fathoms, dark green mud and sand; 4,485, same locality, 89-108 fathoms, soft green mud and sand; 4,510, off Point Pinos Lighthouse, 91-184 fathoms, gray mud; 4,522, same locality, 130-149 fathoms, gray sand and shells; 4,523, same locality, 75-108 fathoms, soft dark mud.

*Onuphis vexillaria* sp. nov. Pl. XVII, figs. 69-76.

A slender, elongated and very distinct species described from a single anterior end and four other pieces which are believed to form a single specimen, complete except for the caudal end. The aggregate length is 159 mm., the width without parapodia 3 mm. and including them 4.2 mm. in the middle region; and the total number of segments 242.

Prostomium small, nearly circular, with a slight posterior emargination, convex, its surface largely occupied by the bases of the tentacles, which are arranged in the form of an ellipse. Frontal tentacles short, thick and ovate, about one-half length of prostomium, short pedunculate, divergent and separated by a space exceeding their diameter. A pair of minute eye-spots at the medial side of their bases. Dorsal tentacles all with annulated ceratophores and slender smooth styles. Anterior pair reach to middle of III, the style three times the length of the ceratophore which has seven articulations. Posterior pair reaching X, the ceratophore as long as the anterior but with a smooth distal part in addition to seven articulations. Median reaching VIII with much shorter ceratophore of six annuli. Palps immediately anterior to mouth, strongly divergent, stouter and somewhat longer than frontal tentacles and divided by a shallow cross-furrow.

Peristomium narrow, continuing outline of prostomium in a regular dome-like curve, but separated by a well-defined dorsal furrow. It is produced somewhat forward to embrace the prostomium at the sides and dorsally slightly overlaps it as a low, somewhat convex nuchal collar. Ventrally it is cut almost to the posterior furrow by the large mouth, which is partly covered by a broad lip with laterally produced angles. Nuchal cirri slender, tapered, simple, rising high up at the level of the inner lateral tentacles from the extreme anterior margin of the prostomium and separated by one-half their length. They reach to the caudal border of II or well beyond the anterior border of the prostomium.

Anterior metastomial region slender and nearly terete, the first five podous segments of nearly equal length and width, the ratio being about as two to two and one-half, the greatest width being at the anterior end where the parapodia arise. After VII the segments become gradually wider and rather abruptly shorter until by XX they are about five times as wide as long and distinctly depressed with the dorsum flattened. This depressed form continues throughout the middle and posterior region. Furrows generally rather weakly developed except between the parapodia. Integuments rather soft, semitranslucent and grayish except in the subparapodial region, where there are thick, opaque, whitish glandular areas; surface very smooth with highly iridescent cuticle. Pygidium unknown.

Parapodia of anterior end prominent, beginning on II near the ventral level and gradually shifting dorsad until by XV they have attained nearly the dorsal level. Anterior parapodia (Pl. XVII, figs. 69 and 70) are remarkable for the great length of their parts. The first is situated at the extreme anterior end of somite II and is directed only slightly forward. Succeeding ones shift to a more caudal position and lose the forward slope until the sixth is on the middle of its segment and the third is directed straight laterad. They have a rather long pedicle bearing a notocirrus, neurocirrus and slender neuropodial setigerous lobe divided at the distal end into a scarcely perceptible presetal lip and a remarkably prolonged, attenuate cirri-form postsetal lip. Neurocirrus arises near the base of the ventral surface and is of similar form and nearly equal length to the postsetal cirrus. Notocirrus arises dorsally nearly opposite to the neurocirrus from a thickened notopodial pedicle, into which the acicula enter, followed by a constriction and again by a swelling tapering into a long slender style one and one-half to twice the length of the neurocirrus, and the longest exceeding the diameter of the anterior segments

(figs. 69 and 70). Little change takes place in the first five parapodia, but with the sixth the whole parapodium begins to diminish in size, the neurocirrus especially dwindling until by the ninth the entire style has disappeared and the base is represented only by the usual opaque, somewhat swollen, whitish area ventral to the base of the foot, which becomes smaller but continues to the caudal end. The postsetal lip becomes smaller very gradually, but remains to the middle segments as a small conical process. Except that it becomes more slender and assumes the proportions of a gill filament, the notocirrus undergoes little change (fig. 71).

Branchiæ appear on both sides of somite V (fig. 70) as a single filament as long, but much more slender than the postsetal cirrus, arising from the notopodial base in common with and on the dorsal side of the notocirrus. On succeeding segments the filament becomes long and on IX a second appears; additional ones then appearing (symmetrically except as mentioned) up to the number of nine, as follows: three on XIII (XIV on right), four on XVI, five on XIX, six on XX, seven on XXI, eight on XXVII and nine at about XXXV. The last number (fig. 71) continues to at least L. The largest gills on pieces from the middle of the body, the segment numbers being undetermined, bear as many as twelve filaments and the most caudal segments represented bear unifilar gills. Until they possess upward of four filaments, the gills scarcely exhibit a main stem or pinniform structure which is always obvious on the more complex gills. The main stem curves rather sharply dorsad, tapering, and bearing along its lateral side the filaments, which diminish in size to the last. On anterior segments the filaments are shorter than the notocirrus, but farther back they are longer. New ones appear to be added from the growing point at the tip of the stem. Branch blood-vessels from the main trunk enter all of the filaments.

Neuropodial acicula, which on anterior parapodia are not very clearly distinguished from the setæ, are from three to five in a row, rather stout, tapered gently to near the end and then abruptly into slender, very acute projecting tips, appearing at the bases of the dorsal setæ. Notopodial acicula are very long and slender fibers which enter the base of the notopodium and continue far into the cirrus (fig. 71). Perhaps they would be more correctly described as buried setæ.

Except the large ventral crochets, all setæ are colorless or nearly so. All segments bear a small tuft of slender, acute, capillary setæ dorsal to the acicula, among the bases of which are a very few much more

delicate and inconspicuous asymmetrical pectinate setæ with one margin prolonged (fig. 73). The first five parapodia bear in the anterior and ventral part of the fascicle a few larger setæ or hooded crochets (fig. 72) with two accessory teeth below the principal hook and the guards but little prolonged. Some of the larger ones show traces of an articulation near the end. Parapodia succeeding these have the crochets replaced by short setæ with mucronate tips and narrow limbæ. These gradually disappear and no trace of them remains at XXV. Somewhere between this point and somite L, the exact segment undetermined, appear two stout yellow bidentate guarded crochets (fig. 74) projecting slightly and obliquely from below the acicula.

The jaws are imperfectly chitinized, being soft and delicate and except at a few thickened points, pale brown. Mandibles probably abnormal, very small, the form of one half being shown in two pieces in (Pl. XVII, fig. 75). Maxillæ (fig. 76) have long, acute, strongly curved forceps jaws with nearly circular carriers. The two plates of II on the left side have, respectively, six and seven teeth, on the right side eight or nine teeth. Plate III of each side bears an unusually large basal wing and six small teeth; IV is small and bears a single tooth.

No color remains. This species is known only from the type and a small portion of the middle region of another specimen from station 4,401.

Stations 4,326, Soledad Hill, Point La Jolla, vicinity San Diego; 243-280 fathoms, soft green mud; 4,401, Lat. 32° 52' 40" N., Long. 118° 13' 40" W., 448-468 fathoms, green mud and black sand.

*Onuphis nebulosa* sp. nov. Pl. XVII, figs. 58-68.

This species has the anterior end slender with prominently outstanding parapodia, the remainder of the body, so far as known, depressed and of very uniform width and the small gills beginning on VIII or IX. The type, consisting of the prostomium and 83 anterior segments, is 25 mm. long and has a maximum width, exclusive of the parapodia, of 1.3 mm.

Prostomium about four-fifths as long as wide, elliptical with an anterior median emargination, strongly convex above. No eyes detected. Frontal tentacles ovate, about one-third longer than wide and about half as long as the prostomium, arising on the frontal border of prostomium separated by a space of one-half their diameter and bent strongly downward. Anterior paired tentacles arise from anterolateral border immediately behind frontal tentacles; their ceratophores

about equal to frontal tentacles, quadri-annulate; styles two and one-half times as long as ceratophores and reaching to middle of II. Posterior paired tentacles arise on the dorsal surface opposite the middle of the prostomium and just within its lateral borders; ceratophores similar to those of the anterior pair; styles reach somite VII or VIII. Median tentacle behind center of prostomium, similar to posterior paired tentacles, but somewhat shorter, reaching only to VI or VII. Palps cushion-like, arising from posterior ventral surface close to mouth, diverging from median line, the broadly rounded ends projecting beyond the sides of the prostomium.

Peristomium very short above, in the median line only about one-half as long as the prostomium, nearly twice as long at the sides and carried forward to embrace the prostomium, the cephalic margin as a consequence being deeply concave. Ventrally it forms the usual bilobed lip, which is quite distinct from II. Nuchal cirri arise from extreme anterior border of peristomium in line with the posterior paired tentacles and separated by a distance of twice their length, very slender and tapered. Somites II and III equal and elongated, each as long as prostomium and peristomium combined, but no wider than the latter. Both are simple segments, widest anteriorly. Behind III the segments gradually increase in width and decrease in length to X, from which they remain nearly uniform for the length of the piece, being quite simple and about five times as wide as long; dorsally they are flat, ventrally strongly convex, the parapodia arising high up. Furrows well-marked and clean-cut and the cuticle very smooth and highly iridescent.

Anterior parapodia (Pl. XVII, figs. 58 and 59) elongated and rather slender, prominently outstanding and fully equalling the width of their somites, from the anterior ends of which they arise. The first two are directed somewhat forward, but little more than those of *O. vexillaria*. From the ventral level of the first they gradually rise until the dorsal level is attained by the eighth. No important difference is noticeable among the first seven or eight. All have the somewhat prolonged, slightly flattened, neuropodial body terminated by a short and broadly rounded presetal lip and a moderately prolonged postsetal lip decidedly flattened at the base. Notocirri and neurocirri clavate, with thickened bases and more slender distal parts ending bluntly; the former are longer than the postsetal lips and more slender, and below their thickened bases, borne on a slightly constricted notopodial base; the neurocirri more proximal in origin and equal to or shorter than the postsetal lip. At the eighth foot the

neurocirrus begins to undergo rapid reduction, and by the eleventh its conical form and cirrus character are lost and it has assumed the form of a low, smooth, rounded, opaque and whitish swelling, which increases in size to about XXV and then diminishes gradually, though it remains as a small whitish spot even at the end of the piece. The postsetal lobe retains its character longer, undergoing very gradual reduction after X and shifting more ventrad. Even at XX it is quite as long as the body of the parapodium and of a short conical or sub-triangular form. At L (fig. 60) it is a minute blunt papilla, ventro-caudad of the seta tuft, and farther back disappears altogether. Notocirri become more slender, but retain their length, continuing to reach the middle line as far back at least as the eighty-ninth segment. In the middle region the bodies of the parapodia are reduced and somewhat compressed and bluntly rounded, and are situated near the level of the dorsum.

On the three specimens known the gills begin as single filaments on somites VIII or IX and never possess more than four filaments, and that number only rarely. Two filaments appear at from XXII to XXVI, three at from XXXIII to XL and continue to LVI or LXIX where the number is reduced to two again and so continues to the end of the several pieces. Not infrequently a segment fails to develop a gill on one or both sides and frequently the number of filaments is below the normal of the region. The gills, though of few filaments, are typically pinnate (fig. 60) and the filaments rather thick and short, the longest very constantly reaching just to the median line. They arise on the dorsal side of the notocirri on a common notopodial base.

Acicula of anterior neuropodia usually three, yellow, stout, tapered, gently curved and terminated by long freely projecting mucronate tips. On posterior neuropodia there are often only two acicula which are like the anterior ones except that they are rather abruptly bent near the distal end. Notopodial acicula are three or four delicate fibers which enter the base of the notocirrus.

Setæ are of vitreous structure and all more or less yellow, the more slender ones being very pale, the stouter ones deeper. The usual four kinds occur, but they present greater variation and more transition forms than usual. Articulated crochets (Pl. XVII, figs. 61, 62) are confined to the first eight parapodia. On the first three they occur in an irregular, open, vertical, preacicular series of three or four, one or two on the acicular tubercle beneath the aciculum and one post-acicular—about six or seven in all. On the fourth foot (V) those in the dorsalmost part of the fascicle are replaced by simple acute setæ, but

at least one compound crochet persists to the eighth foot and three to the seventh. They are rather slender, with well-developed articulation and distal pieces that vary much in length (figs. 61 and 62) the longest being dorsal, the shortest ventral. They end in a slender, acute, strongly hooked tip, beneath which are two prominent and acute spurs, the whole enclosed in a split guard closely fitting the terminal hook and scarcely prolonged beyond it. Simple, acute setæ are represented by one or two small ones on the first and second parapodia, but are not clearly distinguished from the acicula, above and behind which they lie. Farther back they become more numerous, longer, much more slender, and finally even the very narrow limbus that they present anteriorly disappears. On posterior parapodia the fascicle is composed exclusively of six or eight setæ of this type. In the subacicular region the articulated crochets are replaced by short, rather broad, acute setæ, more or less distinctly articulated (fig. 63). Such setæ continue to between somites XV and XX. The larger articulated crochet which appears in the acicular process of anterior parapodia seems to persist, become stouter, lose its articulation and gradually its terminal hook (fig. 65), thus becoming converted into a simple bidentate hooded crochet similar to those occurring on posterior segments. This transition is well shown up to somite XV of the mounted cotype. Apparently, however, there is a gap between the last of these and the first of the posterior simple crochets, two of which appear together ventral to the acicula at about somite XX of these specimens. Unlike the anterior crochets, they project only slightly. They are deep yellow, stout, bifid, with the main tooth below and have the end enclosed in the usual cleft hood (fig. 66). Pectinate setæ (fig. 64) occur in the dorsal fascicle of most segments, but their exact distribution was not determined. They are very delicate, with the widened end very little curved and bearing only a small number of rather long processes.

Jaws described from a single dissection. Mandibles (fig. 67) soft and thin, the carriers nearly colorless with a black streak distally, narrow, of nearly uniform diameter, lightly united at the distal end; masticatory plates white, irregularly trapezoidal, each divided by a deep anterior notch into two large teeth, each of which is again notched. Maxillæ (fig. 68) thin, very pale brown with narrow deep brown marginal lines and thickenings; carriers of forceps-jaws as wide as long, shield-shaped, with straight transverse hinge line; basal half of forceps thickened, distal slender, regularly tapered, moderately curved and acute. Maxillæ II large, subtriangular plates, each of the three bearing

ten (or the outer left, nine) small, regular close teeth. Maxillæ III curved, ridge-like pieces, the left with six, the right with eight small teeth. Maxillæ IV very small, edentulous.

Color generally dull olive-gray, becoming purplish and more iridescent anteriorly, except on the parapodia and cephalic appendages. Dorsum and to a less extent the sides obscurely clouded, or on one specimen distinctly mottled with dusky. Except on the first ten or twelve segments, there is a more or less distinct double dorsal median dark brown line showing a tendency to break into metameric spots. A series of dorso-lateral spots above the parapodia. Like so many of the species taken at the same station, the surface is marked with strictly quadrate spots scattered over the head and its appendages, parapodia and body segments.

A complete tube is 152 mm. long and has an external diameter of 2.5 to 3 mm. Its foundation is a rather tough membranous lining intermediate in character to that of ordinary *Nothria* and *Hyalinæcia* tubes and having a diameter of 1.4 mm. The tubes are very fragile and covered externally with a thick but irregular layer of sand grains and small pebbles. Many of them bear a few rather large pebbles, especially near the lower end, where they probably serve as anchors. One is peculiar in the development at one end of an expanded disk, from the margins of which radiate irregularly a number of hollow fibers or minute tubes probably the work of another than the rightful occupant.

Thirty tubes and three worms were taken at the only station, 4,454, off Point Pinos Lighthouse, Monterey Bay, 65-71 fathoms, green mud, sand and gravel.

***Diopatra ornata* sp. nov.** Pl. XVIII, figs. 77-85.

So far as known, this species is below the size usual in the genus, but all of the four specimens are incomplete. The type and most complete one is in three pieces, having an aggregate length of 84 mm. and 121 segments. Maximum width (at XX) of body only 3 mm., between tips of parapodia 4 mm.; depth 1.8 mm.

As viewed antero-dorsally, the prostomium is nearly circular, being bent downward with a nearly vertical flattened frontal face, the seven tentacles almost in contact at their bases, radiating regularly from a point anterior to the center of the prostomium, the flattened circle enclosed by their bases scarcely exceeding the sectional area of any one of the tentacles, while the region posterior to the tentacles is strongly convex. Frontal tentacles almost in contact on anterior margin, about as long as prostomium, conical, obscurely annulated. Anterior paired



tentacles situated slightly dorsal to margin, immediately behind and almost in contact with frontal tentacles, reaching to VII or VIII; the ceratophores slightly longer than frontal tentacles, divided to the end into eight or ten annuli; the styles smooth and slender. Posterior paired tentacles on dorsum well back from margin and immediately above and behind anterior paired, reaching to XV or XVI; ceratophores shorter and stouter than anterior paired, nine- to eleven-annulate. Median tentacle posterior to middle of prostomium, reaching XIV, with a shorter ceratophore having nine annuli. Apparently all of the tentacles have lost a short portion of the tip and each one is marked by a more or less distinct broad purple zone. Palps prominent, divergent and directed ventrad, bilobed by a shallow transverse furrow. No eyes detected and *pigmented* eyes certainly absent.

Peristomium nearly as long as prostomium, its anterior end scarcely wider, little concave and its sides continuous with prostomium, its dorsum strongly convex. Nuchal cirri on anterior margin of peristomium, slightly longer than prostomium and reaching two-thirds or three-fourths to base of opposite cirrus, regularly tapered from base to tip, often with a purple spot. Ventrally the peristomium forms a pair of thick folds behind the palps and a bilobed hinder lip. The next two segments, each about as long as peristomium, slightly carried forward at sides to bear parapodia and embrace the preceding segment, but not conspicuously enlarged. Succeeding segments become slightly wider to about XV, after which they remain practically unchanged. Those of middle region about four times as wide as long, smooth, simple, rather strongly depressed. Pygidium unknown.

Parapodia of the prebranchial region (Pl. XVIII, fig. 77) large and prominent, the undivided body alone of the first three exceeding one-half the width of their segments, projecting somewhat forward from the anterior ventro-lateral region of their segments. They have stout, slightly compressed, subtruncate, cross-furrowed, chiefly neuropodial bodies and the usual notocirrus, neurocirrus and postsetal lobe or middle cirrus, all of which are rather stout and subconical, the postsetal lobe being somewhat flattened and the notocirrus about one and one-half times as long as the others, with a basal constriction. The fourth foot (on somite V) is similar to the three preceding ones, but decidedly smaller. With the fifth a considerable reduction in size takes place and the parapodia have approached the dorsum, at which level all succeeding ones remain, the body becoming at the same time much reduced, short, truncate, subconical and directed somewhat dorsad. At the fifth parapodium the neurocirrus becomes much

shorter and bluntly rounded at the apex; at the sixth it is replaced by an oval glandular swelling, which increases in area but becomes less elevated for six or seven segments and then undergoes gradual reduction in the post-branchial region. After the appearance of the gills on VI the notocirrus also undergoes reduction, but so gradually that a small cirrus is still present on the one hundred and twenty-first segment. The postsetal lobe becomes smaller simultaneously with the notocirrus, but much more rapidly, soon becoming minute and shifting to a post-setal position and practically disappearing by the end of the branchial region.

Gills begin on somite VI and continue to XLIX to LII on the several specimens. They arise on the dorsal side of the base of the parapodia by a stout base, on the ventral or lateral side of which the neurocirrus is borne (Pl. XVIII, fig. 78). Several anterior pairs are very large, the second in all cases exceeding all of the others and reaching quite to the tip of the notocirrus of the opposite side, the first being about seven-eighths and the third about three-fourths or more as long as the second. Succeeding ones diminish in length, at first rapidly, then slowly, the eighth equalling the body width, the twenty-first reaching the middle line, the forty-first being only as long as the notocirrus. Anterior gills are tall and slender when fully extended, being shaped much like Lombardy poplar trees. The trunks have stout, feebly annulated bases above which they taper and are spirally twisted, bearing numerous, rather short spirally arranged filaments which become smaller distally. This spiral arrangement of the gills persists to at least XXXV, the number of turns varying with the length of the gill, the second and longest having twelve. Beyond somite XXXV, the trunks have become so short and the filaments so crowded that the appearance is brush-like. At XL there are only three short filaments, and the last seven gills consist of a single filament, each of which gradually diminishes in length.

Neuropodial acicula three or four, tapered, curved, terminating in acute tips projecting beyond the end of the acicular process. Notopodials one or two delicate rods or a bundle of fibers.

Setae of the first four parapodia (II-V) chiefly compound crochets (Pl. XVIII, 79 and 80) arranged in a loose vertical preacicular series of about six or eight, of which one, much stouter than the others, is subacicular and one more slender postacicular. The latter (fig. 80) has the appendage considerably longer than the rest. All have the articulation well-developed, the end very strongly hooked and provided with a prominent accessory spur and well-developed guard, the end of

which is somewhat obliquely prolonged. On at least the first branchiate parapodium a few semicomound, sometimes acute (fig. 81), sometimes obscurely hooked setæ persist, but give place to true acute simple setæ on subsequent segments. A few short, simple setæ occur in the dorsal part of the supra-acicular region of the first foot, and they soon form a well-marked, curved, horizontal series dorsal to the acicular process. These setæ are slender with a very narrow limbus. On anterior branchiate parapodia, beginning with VI and continuing to about XXX is a vertical row of five or six short, stouter, thickened, but alimbate setæ forming a vertical preacicular fascicle. These disappear as the gills become short and the stout ventral crochets appear, leaving only the dorsal group of acute setæ, which become longer. Beginning somewhere between VI and X, and at first few in number, but increasing to a compact tuft clustered among the dorsal acute setæ and persisting with them to the end of the worm, are delicate gouge-shaped setæ with finely pectinate border (fig. 82). A stout yellow crochet (fig. 83) appears below the acicula at about XXX and a few segments behind is joined by a second; they have a strong beak, short, thick accessory tooth and a pair of small guards.

Mandibles dark brown with pale masticatory plates. Stems rather broad, of nearly uniform width, the distal end scarcely widened, the two sides very slightly united by a slender and short isthmus. Masticatory plates small, transversely elliptical, scarcely toothed (fig. 84). Maxillæ (fig. 85) dark brown, massive, opaque. Forceps jaws (I) massive, the carriers broad, together nearly orbicular with a flexible median joint and a posterior median notch; hinge line short; forceps with basal half thick, tapered to the incurved subacute ends. Maxillæ II broad, triangular, the cotype figured with the inner left plate absent, the remaining pair nearly symmetrical, the left with seven, the right with eight teeth, the most anterior in each case being larger than the others. The type has the normal arrangement of two pieces on the left side and one on the right, each bearing seven teeth like those figured. Maxilla III large curved plates usually with eight unequal teeth on each side. Maxilla IV small plates bearing a single small tooth.

Color generally faded to a dull gray, the anterior end slightly purplish and purple zones on the cephalic tentacles and spots at the base of the nuchal cirri. Cuticle slightly iridescent.

Some fragments of the exposed ends of tubes have the usual structure, with a tough, parchment-like basis thickly covered with pebbles, bits of shells, coral and other hard bodies mostly arranged transversely.

They closely resemble the tubes of *Diopatra cuprea*, but are scarcely more than one-half their diameter.

Stations 4,457 (tubes only), off Point Pinos Lighthouse, Monterey Bay, 40-46 fathoms, dark green mud; 4,467, off Santa Cruz Lighthouse, 51-54 fathoms, soft dark green mud; 4,519, off Point Pinos Lighthouse, 27-35 fathoms, hard gray sand (type).

*Hyalinœia juvenalis* sp. nov. Pl. XVIII, figs. 86-95.

A small species represented by the anterior ends of two individuals, which, though mature, retain certain characters of setæ, etc., which are found in quite young examples only of *H. tubicola*. The cotype, comprising the head and 35 segments, is 19 mm. long and 1.9 mm. in maximum width. The type, of the same size, has 32 segments and a posterior regenerating cone.

Prostomium trapezoidal, the greatest width posterior and about one-third more than the length, the anterior and posterior sides convex, the converging lateral sides nearly straight. Frontal tentacles small, less than one-third length of prostomium, situated at antero-lateral angles, directed somewhat ventrad, but little divergent, subfusiform, about twice as long as thick, the pedicles much constricted. Median and posterior lateral tentacles situated well within posterior half of prostomium close together on dorsal face; anterior lateral tentacles farther forward on lateral margin. Ceratophores of anterior paired tentacles about as long as thick and 4-annulate, styles thickish and stout, barely reaching III. Ceratophores of median and posterior paired tentacles very short, obscurely divided into three annuli, the styles smooth, moderately slender, about one-half the diameter of the anterior pair, tapered, the median reaching to IX, the longest lateral to XI. Eyes black, very conspicuous, immediately behind the anterior and below the posterior paired tentacles. The type has but one pair about one-half the diameter of the base of the anterior tentacles; the cotype bears a second pair, almost as conspicuous and immediately dorsal to the first pair. Palps rather small, about one-third width of prostomium, globoid, directed ventrad immediately in front of mouth and only slightly in contact medially.

Peristomium small, scarcely wider than prostomium and less than one-half as long, bearing the bilobed posterior lip. Somite II very much larger, nearly twice as wide and three times as long as the peristomium, extending forward and embracing the sides of the latter. The next few segments diminish in length rapidly until the normal length to width ratio of one to four or five is reached at somite VI. Beyond this point the segments continue to increase in size and the

maximum diameter is probably not quite attained in these pieces. The first few segments are firm-walled and bounded by deep furrows, but farther back they become softer and the furrows shallower. All are nearly terete, but slightly flattened and grooved ventrally. Pygidium a very small, short, truncate cone bearing a pair of very slender tapering cirri about one and one-fourth times the greatest diameter of the body.

Parapodia generally similar to those of larger species, but relatively less enlarged and prominent. First pair (on II) largest, projecting forward and slightly ventrad, but barely reaching level of anterior border of palps, truncate, conical, transversely furrowed and terminated by a broad, flat, prominent, preacicular lip and a slender but about equally long, more cirriform postacicular lip. Both notocirri and neurocirri are simple, conical styles without differentiated cirrophore and of similar form and size, not quite reaching the end of the terminal lips, the neurocirrus arising on the antero-ventral part of the base of the neuropodium close to the side of the mouth, the notocirrus nearly half-way out on the postero-dorsal aspect of the foot. The second foot (Pl. XVIII, fig. 86) is similar, but decidedly smaller and projects very little forward and ventrad. The third is modified still farther in these respects, and the fourth (fig. 87) has attained the typical position and nearly typical proportions and differs particularly from preceding parapodia in its much shorter, blunt neurocirrus. The one figured (fig. 87) has the postsetal lip abnormally bifid. On the first parapodium the postsetal lip is shorter than the presetal, but on the second this relation is reversed and the latter disparity becomes more pronounced on succeeding parapodia until at somite X the postsetal lip becomes again reduced to the length of the presetal lip and assumes the form of a small cylindroid papilla. This continues to diminish, shifts to a more ventral position and finally disappears, leaving only the short, broadly rounded presetal lip of the low, flat parapodia of middle segments (fig. 88). Notocirri undergo very regular and gradual diminution in size and with the appearance of the gills (about XX) have become quite minute and little longer than the presetal lip, appearing as small processes from the outer side of the base of the gills. Neurocirri remain the same for the first three parapodia and then very abruptly become altered to a small, thick papilla. which in the course of one or two more segments becomes absorbed into a low swelling and extensive glandular region ventral to the parapodium.

On the cotypho gills begin symmetrically on XIX; on the type there is a small one on one side of XVIII, fully developed ones on both sides

of XIX, none on XX and then from both sides of XXI caudad. On both specimens they continue to increase in length gradually and probably reach their maximum size at XXIII where they about reach the dorsimeson and are five to six times the length of the dorsal cirrus, the length of which, indeed, scarcely exceeds their diameter (fig. 88). They have the usual structure, being coarse filaments containing a large axial blood-vessel, and within the limits of the piece exhibit no indication of becoming flattened.

Neuropodial acicula pale yellow, generally three, but posteriorly only two, stout, tapered, slightly curved, the pointed apices projecting only slightly beyond the integument. Notopodial acicula a small fascicle of fibers.

Setæ of four kinds. The first three parapodia bear a few stout, compound crochets in a vertical series. They are especially large on the first and project freely forward. On the second and third parapodia (fig. 89) they become smaller and paler in color. None seem to be truly compound, but the oblique joint is imperfect and near the end. The shaft or portion of the setæ proximad of this interruption is slightly thickened in its distal portion and minutely roughened, partly with minute imbricated, antrorse scales and partly with minute hairs. The distal piece or appendage is somewhat recurved, tapered to the peculiarly formed bidentate tip, which is enclosed in a pair of broad obliquely truncate guards. It is possible that larger specimens (should such occur) would lose some of these characters through wear. Beginning on the fourth foot (V), the compound crochets (one or two of which may remain, though there are none on these specimens) are replaced by simple setæ which are characterized by a finely roughened enlargement beyond which they taper to an acute curved tip. Farther back these setæ are partly reduced in size, but chiefly transformed into small supra-acicular and subacicular fascicles of simple setæ with broadly bilimbate, lanceolate blades (fig. 91). Associated with these setæ in the dorsal fascicle, beginning on the second foot is a dense tuft of very delicate pectinate setæ, the abruptly widened end of which (fig. 92) is bent into semicircular form and bears about thirty regular and equal teeth and mucrons. On posterior segments they become much wider and flatter. Beginning at about somite XX, two stout, yellow, slightly clavate, bluntly rounded bidentate and guarded crochets appear in the subacicular fascicle of each crochet (fig. 90).

Jaws thin and fragile, but hard and well-chitinized. Mandibles (figs. 93 and 94) pale brown, with some dark streaks, the stems regularly tapered, slightly enlarged at the distal end where the two are feebly

united. Masticatory plates white and hard, slender, ovate, with smooth or slightly wavy margins, borne in a distal depression of the stem which projects beyond the masticatory plate on the lateral side as a blunt tooth. The mandibles of the type are much larger than those of the cotype, though the two worms differ but little in size. Maxillæ (fig. 95) pale brown, the teeth and other thickened parts darker. Carriers of forceps-jaws (I) broad, together about four-fifths length, subquadrate, with a short, blunt projection at the postero-lateral angle; the forceps with basal half broad and nearly straight, the distal half slender, tapered and not very strongly hooked. Maxillæ II, outer left plate with thirteen large and one or more very small posterior teeth, inner left with twelve teeth, right plate with fourteen or sixteen or even more teeth. Maxillæ III, left with seven to nine small teeth, right with about ten teeth. Maxilla IV, delicate, with one small tooth or none.

Generally pale or colorless, a small, indefinite, median dorsal, purple spot on anterior dorsal part of prostomium, a pair of small ventral spots below outer lateral tentacles, small brown spots at base of notocirri and a few dark speckles on anterior segments. Cuticle only slightly iridescent.

A probably incomplete tube is 65 mm. long, slightly curved and tapered, the large end being 2.5 mm., the smaller 2.2 mm. The surface is rougher than that of small tubes of *H. tubicola* and the annulations are 2 mm. apart and obscure. Although translucent and nearly free of incrustations, it is not possible to determine the character of the valves.

An empty tube has living within it a small polynoid, not yet removed for examination, and, completely closing the larger orifice so that the annelid could not leave, is a small hermit crab (*Eupagurus* or *Parapagurus*) with very unequal chela, the right being much the larger and forming a symmetrical plug beautifully adapted to the form and size of the tube.

Type and only station 4,431, off Santa Rosa Island, 38-45 fathoms, varied bottom.

**Hyalinœcia tubicola** (Müller) Malmgren, **stricta** subsp. nov. Pl. XVIII, figs. 96, 97.

*Hyalinœcia tubicola* Malmgren, Öfversigt Kongl. Vetens-Akad. Förh., XXIV (1867), 181, 2, Taf. IX, fig. 49.

This is a form of large size, as indicated by the measurements of the tubes given below, somewhat exceeding *H. artifex* Verrill. In many respects it resembles *H. t. longibranchiata* McIntosh, from the vicinity of New Zealand, but has no eyes.

Ceratophores of cephalic tentacles, either not annulated or obscurely 3- or 4-annulate. Anterior paired tentacle reaches IV or V, posterior paired XIII to XVII on different specimens, and median tentacle usually to XX. Somite II is much enlarged, being fully double the length of the peristomium, and its very large stout parapodia bear three or four stout spines which reach quite to the anterior level of the prostomium. Neurocirri of the first parapodium lie close to the sides of the mouth; they diminish in size after the third foot (IV) and become obsolete after VII. On different specimens the gills begin on from XXVI to XXX and at their maximum development reach about three-fourths of the width of the dorsum. They continue to the twelfth segment preceding the pygidium, becoming rapidly reduced in size toward the caudal end. Pygidium ending in a furrowed circumanal ring directed dorsad and bearing a pair of subanal cirri arising in contact, flagelliform, very slender and as long as the last eleven segments or twice diameter of body.

The distinctive features of the subspecies are found mainly in the large posterior crochets and the jaws. The former (Pl. XVIII, fig. 97) have the terminal teeth continued nearly in the direction of the shaft and not placed at a considerable angle with it as in most forms. Pectinate setæ have the plates bent into two-thirds of a circle with very numerous denticulations. A young specimen (about 2 mm. in diameter) still retains on the large spines of anterior parapodia traces of terminal teeth and guards (fig. 96).

The maxillæ are long, with numerous teeth: II left side outer plate 18 teeth, inner plate 15 teeth, right side 17 teeth; III, left 9 teeth, right 10 teeth; IV rudimentary with one tooth on each side. Mandibles have the two sides entirely distinct.

The anterior end of the body and the head are minutely speckled with pigment.

A typical example of the more than thirty tubes in the collection is 198 mm. long, 4.5 mm. in diameter at the small and 6 mm. at the large end. Others vary from 72 mm. long and 3 mm. in diameter to 236 mm. long and 7 mm. in diameter, the great majority being about 200 mm. long. They are gently curved and tapered and toward the larger end elliptical, not circular, in section, the diameter in the plane of curvature being slightly less, indicating a dorso-ventral depression. The tubes have a quill-like texture, but are harder and more rigid than any quill of similar size and can be cut with a knife only with difficulty. The maximum thickness of more than  $\frac{1}{2}$  mm. is at the middle, where the number of layers is greatest and diminishes most toward the large end



where the last inch or so is rather soft and semicollapsible. For the entire length the tube is marked with annular lines which, on a tube 198 mm. long, are 6.5 mm. apart at the small and end 5 mm. apart at the large end. These annulations are formed by the exposed edges of the successive layers of material, which are laid down on the inside and project beyond the orifice to a distance equal to that between two rings. Thus a tube showing thirty-five rings has probably been constructed of as many successive layers of material.

Both orifices are guarded against intrusion by several sets of soft membranous valves, usually three or four at the large end and probably as many at the small end. These are placed in pairs consisting of a wide dorsal and a ventral flap or pocket attached obliquely to the inside of the tube in such manner that the free borders directed toward the orifice meet in the middle and thus effectually bar against entrance, while yielding readily to pressure from within. Presumably, should a worm leave its tube it would itself be debarred from re-entering. One small tube (110 mm.) has the orifice ornamented with a few foraminifera shells, sea-urchin spines and small pebbles.

Evidently the tubes wear away at the small end, the worm occupying the newer parts and building extensions at the large end and at the same time removing old valves and replacing them by new pairs. It is evident also that the length of additions decreases as the tubes become larger and that there is much individual variation in this respect.

Old tubes are always covered with a friable black incrustation, except on the newer parts at the large end, and especially adherent at the rings. Some of them also bear growths of hydroids and an occasional barnacle (*Scalpellum proximum* Pilsbry) small tunicate (*Styela*) or small actinian (*Sagartia* sp.)

Found at only one station, but there in abundance: 4,387, vicinity of San Diego, Lat. 32° 32' 40" N., Long. 118° 04' 20" W., 1,059 fathoms, green mud.

#### LUMBRINERIDÆ.

This is another fairly well-represented family and from the point of view of geographical distribution is interesting because, more than any other family, it resembles the fauna of the southern Pacific coast of South America. This resemblance is seen not alone in the fact that the two regions possess two species in common, but also in the resemblance of other species which are distinct.

*Ninoe gemmea* sp. nov. Pl. XIX, figs. 101-109.

Form moderately elongated, slender and terete, the anterior branchiate region wider and depressed. A complete example (type) is 104 mm. long with a maximum width, exclusive of parapodia, of 2.4 mm. at XXX. Segments 146.

Prostomium small, slightly longer than wide, distinctly depressed, subovate, continuing the outline of the anterior end of the body forward to a subacute apex, very smooth and differentiated only indistinctly from the peristomium at the sides. The mid-dorsal portion of the pro-peristomial furrow forms a broad but shallow, semicircular or crescentic furrow, the horns of which end at a pair of small translucent spots marking the tips of the forward lateral projections of the peristomium. It is uncertain whether or not a minute obscure papilla exists at the bottom of this nuchal furrow. On the ventral surface is a pair of slight submarginal longitudinal grooves which meet the lateral furrows bounding the prominent quadrant-shaped palps which are separated by a deep medial furrow. No eyes.

The outline passing from the prostomium into the peristomium and body is very regular and unbroken. Peristomium and somite II apodous, together equalling the prostomium in length; the peristomium longer at the sides, but dorsally cut into by a deep re-entering bay, reducing it to the length of II. Ventrally they coalesce to form a deeply furrowed lip. Segments simple, very smooth and regular, and separated by deep, even furrows, the length to width ratio varying from one to four or five at the anterior end to one to two at the posterior end, toward which their length increases both relatively and actually. From the point of greatest diameter at about XXX, the body tapers very regularly and gently to the caudal end, being for most of the length strictly terete. Cuticle highly polished, with a pearly iridescence.

Pygidium a small, obliquely flaring ring, bearing at the sides of a small ventral platform a pair of conical cirri about as long as the diameter of the pygidium.

Parapodia strictly lateral, uniramous, with quite rudimentary notopodium. The first few are very small, slightly compressed tubercles with obsolete presetal lip and subfoliaceous, cuneate-ovate postsetal lip as long as the body of the foot (Pl. XIX, fig. 101). Farther back, in the branchial region, the presetal lobe becomes a hemispherical swelling, which is again lost posteriorly. At VI, or in one case, V, the postsetal lip bifurcates, the ventral lobe remaining as before, the dorsal being cirriform and slightly longer. On succeeding segments the

latter becomes more distinct and larger than the other branchial filaments and curves somewhat dorsad into a suberect position (fig. 102). The remainder of the postsetal lip then divides into the filaments of the digitate gill, the ventralmost filament of which retains a trace of the foliaceous condition in a small basal wing. Otherwise the branchial filaments resemble the dorsalmost filament or cirrus, and where best developed only equal the foot in length and spread in a palmate fashion (fig. 103). On the type there are two filaments at X, three at XIII, continuing with three or occasionally four to XLIX. The filaments increase in length to about XL and then rapidly diminish without change in number to XLIX, at which segment the dorsal one alone remains. It bears a small basal wing and remains quite prominent for many segments and finally after reduction to a small postsetal papilla continues to the end. A slightly larger cotype has two branchial filaments at VIII, three at XVI, four or rarely five between XX and XLII and three from XLII to LII. In the postbranchial region the parapodia (fig. 104) are more slender and relatively more prominent, cylindroid with the end slightly cleft into presetal and postsetal lips, the latter a subconical papilla. A minute notopodial papilla at the dorsal base of the neuropodium of all segments.

Neuropodial acicula black with pale bases, usually four, slightly tapered to blunt tips which reach, but ordinarily do not project beyond, the surface. Notopodial acicular fine fibers which pass from the segments above the parapodia strongly ventrad, curving into the notopodial tubercle.

All setæ have black or dark brown stems and pale ends, which on the limbate setæ includes the entire blade. All setæ are simple, and limbate setæ and crochets occur together on all parapodia, the former being more numerous on anterior, the latter on posterior parapodia. All are very brittle and, owing to the frequency with which they are broken, the exact arrangement was not determined. At least one crochet occurs in the subacicular fascicle of III along with three or four limbate setæ, of which an equal number exist in the supra-acicular fascicle. At X there are four supra-acicular acute limbate setæ, six subacicular limbate crochets and below these two more acute setæ. At XXV the numbers are respectively seven, five and one. On posterior parapodia the usual arrangement is one acute seta and one crochet in the supra-acicular fascicle and four crochets in the subacicular fascicle.

The pointed setæ (Pl. XIX, fig. 105) are of the usual bilimbate type and either simply or sigmoidly curved. Some of those in the dorsal

fascicle of anterior segments have the wings abruptly terminated and the shaft continued as a very long acute mucron. They differ considerably in length and proportions in the same bundle and posteriorly all become much elongated and slender. Anterior crochets (figs. 106, 106a) are transitional to the acute limbate setæ, having long, slender limbate ends passing into delicate rounded hoods which enclose the small, indistinctly toothed heads. Though gradually diminishing in length, they undergo no conspicuous change through the branchial region, but posteriorly become converted into true crochets (fig. 107) which are alimbate, somewhat stouter and have shorter, thicker ends and more inflated hoods enclosing a well-developed beaked and crested head.

Mandibles (Pl. XIX, fig. 108) delicate, flexible and nearly white, except that the tips of the masticatory plates and a pair of submedian lines are black. Carriers or stems long and slender, separated for about the posterior two-thirds of their length, firmly united anteriorly and widened into a broad plate bearing the narrow, strongly curved continuous masticatory plate which terminates in a strongly but irregularly toothed apex. Maxillæ (Pl. XIX, fig. 109) deep brown, opaque, the forceps jaws with long bases or carriers nearly equal to the jaws in length, together having the outline of an urn, but not united medially; hinges well-developed and the jaws very strongly and regularly curved. The large dental plates (II) are massive, symmetrical and each provided with a series of eight regular stout teeth on the inner margin. Maxillæ III small, narrowly ovate with one large hooked tooth succeeded by a slightly curved, serrate margin. Anterior maxillæ (IV) large, with similarly serrate, medial margin, but the large tooth less well-developed. A pair of long, narrow, brown, chitinized bands lie at the sides of the large dental plates.

Integuments unpigmented, but cuticle with a beautiful pearly luster.

Known from three specimens, one each from stations 4,450 (type), off Point Pinos Lighthouse, Monterey Bay, 55-60 fathoms, dark green mud; 4,485, off Santa Cruz Lighthouse, Monterey Bay, 39-108 fathoms, soft green mud and sand; 4,523, off Point Pinos Lighthouse, 75-108 fathoms, soft dark mud.

**Ninoë fusca** sp. nov. Pl. XIX, figs. 110-118.

This species, described from a single incomplete specimen, has the general *Lumbrineris* build, but is stouter and more depressed than most species of the genus. The type, consisting of two pieces together

comprising 120 anterior segments, is 48 mm. long and has a maximum width of 3.5 mm. at somite XXV.

Prostomium (Pl. XIX, fig. 110) nearly an equilateral triangle with bluntly rounded apex. A slightly elevated median dorsal field is bounded by a pair of shallow grooves which extend from near the apex to the nuchal fold where they include nearly one-half of the prostomial width between them. At these points the prostomium is attached to the peristomium by a pair of folds having almost the form of ball-and-socket joints, separated medially by a deep nuchal pit much wider than long and covered by a nuchal fold of the peristomium. No eyes. Ventral surface smooth with a deep transverse fissure just anterior to the palps. Palps subquadrate cushions separated by a median furrow, their lateral ends trilobate and partially united with the peristomial lip behind. Immediately behind them and anterior to the lip is a small fold guarding the end of the mandible.

Peristomium and II achæitous, together not as long as the prostomium, but much wider; I slightly longer and wider than II and thickened below to form the lateral lobes of the lip. The anterior median region of the peristomium forms a nuchal fold which roofs the nuchal pit between it and the prostomium. When this is drawn back as in fig. 110, the posterior or peristomial face of the pit is seen to bear a vertical groove lodging a small and apparently retractile cirrus or papilla, the merest tip only of which is visible when the fold is in place. Anterior somites in general have the dorsum strongly arched and the venter flattened.

Except for the minute, scarcely noticeable notopodial tubercles, the parapodia are uniramous. Anteriorly they are very small and so near to the venter that they are scarcely visible from above. After about XV they are larger and lateral, but remain nearer to the dorsal than the ventral surface. They are short, thick, subcylindrical, somewhat thickened at the distal end, the presetal portion of which forms a hemispherical thickening. The postsetal lip is produced dorso-distally into a small, erect finger-like cirrus or gill containing a large vascular loop. This is fully developed on the first parapodium (III) and undergoes no marked change in the first forty segments (figs. 111, 112), after which it gradually diminishes in size, the thickened distal end of the foot undergoing simultaneous reduction. Toward the end of the piece the parapodia (fig. 113) are more slender and taper to simple blunt points.

Neuropodial acicula are three or four, stout, slightly tapered black rods with colorless bases, the tips bluntly pointed and either not

projecting or projecting only slightly beyond the surface. Notopodial acicula obsolete, corresponding to the extreme reduction of the notopodia.

Setæ moderate in number, disposed in a supra-acicular and a sub-acicular fascicle, the former nearly horizontal, the latter vertical in arrangement. At somite XV there are eight in the former, fifteen in the latter, a number which is reduced posteriorly to three in each group, of which the subacicular are crochets. All are dark brown at the base, pale or colorless distally. Anteriorly acute setæ (Pl. XIX, fig. 114) alone occur. They are long, slender, narrowly bilimbate and slightly sigmoid with prolonged capillary tips. Those in the supra-acicular fascicle longer than the subacicular, but otherwise similar. On posterior parapodia they become shorter (fig. 115). It is impossible to ascertain from the type alone at just what segment crochets appear, but certainly none are present before somite L, and about LXX would appear to mark the point of their appearance. They are slightly stouter than the limbate setæ, with slightly curved, not thickened stems, ending in an imperfect small head enclosed in a delicate hood (Pl. XIX, fig. 116).

Mandibles (Pl. XIX, fig. 117) rather delicate, flexible, soft, white with black or dark brown apices and parallel dark brown lines on the masticatory plates and more delicate brown lines and a heavy median dark band on the carriers. The anterior half of the carriers is a broad solid piece, the posterior half a pair of slender slightly divergent stems. Masticatory plate a continuous, narrow, hard, curved band bordering the free end of the carrier and obscurely toothed at the apex. Maxillæ (Pl. XIX, fig. 118) dark brown or black, opaque. Forceps jaws with base plate or carrier about two-thirds as long as jaws, ovate with a constricted anterior end and straight hinge; the jaws with stout bases and strongly curved ends. First dental plates (II) irregular and each with only two large teeth on medial border. They are possibly abnormal or much worn. The next plate (III) is small and narrow with one large apical tooth, and the anterior plate (IV) is remarkably large, triangular with a single stout tooth.

Color uniform brown.

This species is imperfectly known through a single specimen taken at station 4,397, off Santa Catalina Islands, 33° 10' 15" N., 121° 42' 15" W., 2,196 to 2,228 fathoms, gray mud.

*Ninoë fusca* is closely related to *Ninoë simpla* Moore previously described from Alaskan waters. Both have the nuchal papilla and simple unifilar gills and their setæ are closely similar, but they differ

much in the form of the postsetal lip of the parapodia and of the maxillæ. These two species taken in conjunction with such species of *Lumbrineris* as *erecta* and *tetraura* largely break down the distinction based on the presence or absence of branchiæ that is usually made between the two genera. On the other hand, their possession of the nuchal papilla segregates them from the majority of species of both genera.

The species of *Lumbrineris* and related genera of this region are noteworthy because of their tendency to develop prolonged branchial processes of the parapodia. This tendency seems to be most marked in the fauna of the deeper waters of Monterey Bay and reaches its maximum in *L. bifilaris*.

***Lumbrineris japonica* v. Marenzeller, index subsp. nov.** Pl. XIX, figs. 119-127.

*Lumbriconereis japonica* v. Marenzeller, Denkschr. K. Akad. Wissensch. (1879), XLI, pp. 137, 138, Taf. V, fig. 3.

This well-marked form presents a superficial resemblance to *L. erecta* of the littoral zone of the coast of California, but its technical characters so closely ally it with *L. japonica* that it is regarded as belonging to that species. The chief peculiarity is found in the noteworthy elongation of the postsetal lip of middle and posterior parapodia which is quite as pronounced as in *L. erecta*. The erectness and rigidity characteristic of these processes in the latter species is here absent; they are evidently more flexible and mobile and usually directed laterad in many cases (fig. 120), reminding one of a pointing finger. This feature does not appear on anterior parapodia, on which the postsetal lips are foliaceous, the digitiform or cirriform character usually becoming pronounced by about somite XXXV.

Articulated crochets occur as far forward as III on the type and persist to XXV; on other specimens they were not detected anterior to III, V or VIII, but continued as far as XXX, after which point simple crochets only occur. Limbate setæ may cease at LVI, as on the type, or continue to LXXV. The form of these crochets differs somewhat from those of Japanese examples of the species. (See Pl. XIX, figs. 124, 125.) There is a single chitinized area on each side in connection with the maxillæ, instead of two as in *L. bifilaris*.

The jaws (Pl. XIX, figs. 126, 127) agree very closely with v. Marenzeller's figures. The maxillæ are opaque and very dark brown or nearly black, the mandibles pale brown marked with darker brown lines and the whitish masticatory plates tipped with a black edging.

The type (station 4,464) is 109 mm. long with a maximum width at XII of 2.8 mm. and between setæ tips of 5.7 mm. Segments 201.

Other specimens are slightly larger. Several specimens are marked with coarse pigment spots arranged in transverse bands.

Stations 4,325, off Point La Jolla, vicinity of San Diego, 191-292 fathoms, green mud and fine sand; 4,405, off San Clemente Island, 654-704 fathoms, green mud; 4,406, off Santa Catalina Island, 650 fathoms, green mud; 4,452, Monterey Bay, off Point Pinos Lighthouse, 49-50 fathoms, green mud and fine sand; 4,457, same locality, 40-46 fathoms, dark green mud; 4,464, same locality, 36-51 fathoms, soft dark green mud; 4,467, Monterey Bay, off Santa Cruz Lighthouse, 51-54 fathoms, soft dark green mud.

*Lumbrineris inflata* sp. nov. Pls. XIX, XX, figs. 128-134.

A small and apparently an immature form. At least none of the specimens contains genital products. It presents, however, so many peculiar features that it is probably not the young of any species already described from the Pacific. The type is 68 mm. long, with a maximum width in the proboscis region of about 1 mm. Segments 134. The largest specimen is an anterior end 1.5 mm. in diameter. Form linear, tapering gently to the caudal end, terete.

Prostomium thick and scarcely depressed, length equal to or slightly exceeding width, subgloboid or short ellipsoid, sides and front equally rounded, dorsum strongly convex, venter with a broad, shallow, median groove. Eyes totally wanting. Nuchal isthmus and pit narrow, the peristomium scarcely emarginated. Palps simple cushions, wider than long.

Peristomium distinctly longer than II, which is also apodous, the two together equalling or slightly exceeding the prostomium in length. Dorsally they are sharply differentiated by a distinct furrow and the peristomium is slightly emarginated at the nuchal pit; ventrally they are united to form the furrowed lip, II being produced forward and cutting into I. Succeeding metastomial segments remarkably well-differentiated by deep furrows and more or less biannulate or marked with a narrow, raised, whitish line; anterior segments about three times as wide as long, posterior nearly as long as wide. Pygidium a minute, slightly widened ring bearing four short, equal, symmetrical, conical cirri.

Parapodia (Pl. XIX, figs. 128, 129) arise nearer the ventral than the dorsal surface, especially toward the ends of the body, and are of simple, uniform structure throughout. Neuropodia slightly thickened distally, divided at the end into a very short presetal lobe and a longer, stiffly outstanding postsetal lobe about equalling the body of the



neuropodium in length. Instead of increasing in length and becoming cirriform and highly vascular caudally, as is the case with most species of *Lumbrineris* inhabiting this region, the postsetal lobe, if changed at all, becomes somewhat smaller posteriorly and never shows any indication of becoming erect. A minute papilla at the dorsal side of the base of the neuropodium represents the notopodium.

Neuropodial acicula two or three, pale brown, of the usual tapering form, the tips not appearing beyond the surface. Notopodial acicula very delicate, their ends imbedded in a spherical opaque mass.

Setæ all colorless, of the usual simple limbate and hooded crochet types, the former on the first thirty to forty segments only, the latter on all segments. The number of setæ is moderate, their distribution on the type being as follows: the first foot (III) has seven limbate setæ and two articulated crochets; X has five limbate setæ in the supra-acicular fascicle and four articulated crochets and one limbate seta in the subacicular fascicle; XXV has three supra-acicular limbate setæ and two subacicular crochets, of which the ventralmost is simple; middle parapodia have three or four simple crochets, with which a limbate seta may be associated as far as XL. Other examples have a practically similar distribution, but the last compound crochet may occur at XVIII and the first simple one at XVII. The limbate setæ (Pl. XIX, fig. 130) are in no way characteristic; they are rather sharply bent, very acute and the blades narrowly lanceolate. Crochets of anterior parapodia (Pl. XIX, fig. 131) are imperfectly compound, with an oblique articulation that divides the stem but not the hood, which is, however, adherent to the stem in such a manner as to produce a rather pronounced double inflation; the stem terminates in a high, finely divided crest. Simple crochets (fig. 132) have a short, strongly inflated hood and a long-beaked head surmounted by a crest of fine teeth.

Jaws much like those of *L. hebes* Verrill. Mandibles in one specimen rudimentary, in another (Pl. XX, fig. 133) colorless and delicate, stems long and slender, united by their anterior halves; masticatory plates very oblique, separated by a deep anterior cleft, each when intact with a large apical and a somewhat smaller internal tooth. Maxillæ (fig. 134) dark brown, carriers of forceps jaws (I) with halves very imperfectly united, slender, a deep incision on each side in anterior third, the part posterior to which is more than twice as long as wide and acutely pointed behind; hinge well-developed; the forceps moderately stout in basal third, strongly hooked distally. Large tooth plates (II), with stout body and large outstanding quadrate

lateral wing and four or five stout teeth. The next anterior plate (III) has an oblong, lateral supporting plate and a curved dentigerous margin, bearing three or, in one case, four teeth. Anterior plate (IV) slightly larger than III, with ovate-quadrangle supporting plate and a thick medial border bearing two stout triangular teeth.

All of the specimens are pigmentless with a delicate pale blue cuticular luster.

Stations 4,454, Monterey Bay, off Point Pinos Lighthouse, 65-71 fathoms, green mud, shells and gravel; 4,463, same locality, 36-51 fathoms, soft dark gray mud; 4,496 (type), Monterey Bay, off Santa Cruz Lighthouse, 10 fathoms, fine gray sand and rock.

***Lumbrineris tetraura*** (Schmarda) Ehlers.

*Lumbriconereis tetraura* Ehlers, Festschr. K. Gesellsch. Wissensch. Göttingen, 1901, pp. 137-139, Taf. XVII, figs. 1-10.

A fine example of what is undoubtedly this far southern species was found among some *Aracoda semimaculata*. It is 114 mm. long and 1.6 mm. wide at XII, the spread between the tips of the parapodia at the same place being 3 mm. Segments 121. Compared with Ehler's figures, the prostomium is somewhat shorter and much more broadly rounded and the postsetal lobes somewhat longer and more erect.

The segments often exhibit a faint biannulation. Posteriorly they are somewhat depressed and the appearance of depression is considerably enhanced by the prominent outstanding parapodia which equal the width of the segments. Pygidium a short ring bearing two pairs of cirri, of which the dorsal is somewhat shorter and thicker, the ventral slightly divergent, longer and more slender. Crochets occur on all segments, the anterior being long and limbate with small heads, but they gradually assume the typical form which is attained by about XXXV. A single acute seta continues to at least C. Both setæ and jaws agree closely with Ehler's description, the three pairs of maxillæ having one, two and four teeth, respectively, and the mandible a very characteristic form. It is to be noted, however, that Ehler states that limbate setæ extend to about somite XXI only and that articulated crochets occur in the anterior seventeen segments of young worms.

Station 4,496, off Santa Cruz Lighthouse, Monterey Bay, 9-11 fathoms, hard sand.

***Lumbrineris biflaris*** Ehlers. Pl. XX, figs. 135-142.

*Lumbriconereis biflaris* Ehlers, Festschr. K. Gesellsch. Wissensch. Göttingen, 1901, Math.-Phys. Kl., pp. 139-141, Taf. XVIII, figs. 1-10.

This interesting and abundant species resembles Ehler's south Chilean species very closely in every respect except the structure of

the jaws. Ehler's figure of the latter differs in certain respects so greatly from the form usual in the genus that I have assumed that the single specimen available to him was abnormal or imperfect in these respects. Otherwise these specimens could scarcely be regarded as conspecific with his, notwithstanding their close external similarity. Even on this assumption there is by no means complete identity, and further study of Chilean material may necessitate subspecific or even wider separation.

A set of well-preserved jaws is represented in figures 141, 142, and several others which were dissected agree closely, the principal differences being in the occasional presence of a third large tooth in place of the first small tooth on one of the large-toothed maxillæ (II) and in the variable length of the stems of the mandibles.

The peristomium of Ehler's type is decidedly more elongated than that of the Californian examples, in which the basal width equals the length.

Parapodia of the anterior, middle and posterior regions are illustrated in figures 135-137. Those of the latter region with their two cirriform processes are very characteristic and bear a very close resemblance to Ehler's figure, which, however, is inverted. The ventral outstanding filamentous process is postsetal and the dorsal erect one, which contains a conspicuous vascular loop, is presetal in origin. The notopodial tubercle or rudimentary cirrus is quite distinct from the latter, but becomes obsolete on posterior segments. Parapodia exhibiting this extreme development of the lobes are confined to the posterior third or two-fifths of the body, those in the middle region having them digitiform and only about as long as the body of the foot (fig. 136) and in this respect these specimens differ somewhat from Ehler's, in which the filiform character becomes established farther forward. This difference, though somewhat indefinite, is quite striking and is equally true of large and small specimens alike. The resemblance of the bidigitate parapodia of the middle region to those of *L. bifurcata* McIntosh is striking and, indeed, the two species have much in common, but they diverge in the character of the posterior parapodia (fig. 137).

Although the setæ (Pl. XX, figs. 138-140) in general resemble those of the type in form and distribution, in respect to the latter there are some noteworthy variations and differences. Anterior parapodia bear both limbate setæ and crochets, the latter being themselves limbate, slender and with small imperfect heads; posteriorly only true hooded crochets with short bodies and strongly hooked heads

occur. Ehlers states that crochets occur on all podous segments, the anterior being limbate and that acute limbate setæ cease at LV. On my material crochets may begin on the first foot (III), which is usual, or they may be absent for from four to twelve anterior parapodia. This is notably the case in three specimens from station 4,523, in which the first occurs in X, XII and XIV, respectively, the first two specimens being about 5 mm., the last 3 mm. in diameter. On two still larger specimens 5 mm. and 7 mm. in diameter, from stations 4,406 and 4,402, no crochets were detected anterior to XIX and XXI, respectively. The passage from limbate to true crochets is a gradual one, but typical crochets may usually be recognized at about the fortieth parapodium. The last limbate seta may occur anywhere from segment XLII to segment LXXXIX, the average of fourteen specimens on which this was determined accurately being LXIV. There is no relation between size and the position of the last acute seta, as there is in the case of the first crochet. The variation, however, is less than would appear, for in cases where a large number of parapodia contain acute, limbate setæ, the last twenty or thirty bear but one.

Few of the specimens are obviously pigmented. Most are of a dull gray or yellowish-brown color, one having a russet ground color is marked with narrow dark brown annulations, and one lot from station 4,454, like other species from the same station, is marked with quadrate black spots. The ground is pale slate color with cuticular iridescence. The spots are sharply defined, always confined to one segment, though those of adjacent segments may coalesce. They occur on both dorsal and ventral surfaces, somewhat more plentifully on the former, and apparently increase toward the middle region, leaving the ends of the body less maculated. Individuals differ greatly in the richness of the spotting, some having very few and widely scattered spots, while on others they are numerous and often confluent; some have the prostomium unspotted, while on others it bears from one to three spots.

In all seventy-seven specimens, ranging in diameter from .8 mm. to 7 mm., were examined, and although only a very few were complete all exhibited the characteristic alteration in the form of the parapodia from before caudad and the characteristic arrangement of the setæ. A complete specimen 155 mm. long has 312 segments, and at the point of maximum diameter (XVII) the width is 3 mm. (exclusive of the parapodia) and the depth 2.4 mm. A medium-sized specimen from station 4,574 is packed with eggs.

Although taken at many stations throughout the whole range of

the cruise, only a single one occurs at more than half of them and more than five specimens at 4,454, 4,548 (where thirteen occur) and 4,574 only. The bathymetrical range is great, being from 36 to 2,182 fathoms.

Stations 4,306, off Point Loma Lighthouse, vicinity of San Diego, 207-497 fathoms, green mud, sand and gravel; 4,322, off Point La Jolla, 110-199 fathoms, green mud and shells; 4,364, off Point Loma, 101-129 fathoms, green mud, sand and rock; 4,366, off Point Loma Lighthouse, 176-181 fathoms, green mud; 4,382, off North Coronado Island, vicinity of San Diego, 642-666 fathoms, green mud; 4,390, off Santa Catalina Islands, Lat. 33° 02' 15" N., 120° 42' W., 1,350-2,182 fathoms, gray mud and fine sand; 4,402, off San Clemente Island, 542-599 fathoms, green mud; 4,406, off Santa Catalina Island, 650 fathoms, green mud; 4,416, off Santa Barbara Island, 323-448 fathoms, dark green mud and rocks; 4,431, off Santa Rosa Island, 38-45 fathoms, varied bottom; the following in Monterey Bay, 4,445, off Point Pinos Lighthouse, 60-66 fathoms, green mud; 4,450, same, 55-60 fathoms; 4,452, same, 49-50 fathoms, green mud and fine sand; 4,453, same, 49-51 fathoms, dark green mud; 4,454, same, 65-71 fathoms, green mud, sand and gravel; 4,457, same, 40-46 fathoms, dark green mud; 4,464, same, 36-51 fathoms, soft dark gray mud; 4,467, off Santa Cruz Lighthouse, 51-54 fathoms, soft dark green mud; 4,475, off Point Pinos Lighthouse, 58-142 fathoms, soft green mud; 4,482, off Santa Cruz Lighthouse, 43-44 fathoms, soft green mud; 4,485, same, 39-108 fathoms, soft green mud and sand; 4,507, off Point Pinos Lighthouse, 308-383 fathoms, green mud; 4,523, same, 75-108 fathoms, soft dark mud; 4,541, same, 381-633 fathoms, green mud and sand; 4,548, same, 46-54 fathoms, coarse sand, shells and rock; 4,549, same, 56-57 fathoms, same bottom; 4,550, same, 50-57 fathoms, green mud and rocks; 4,556, same, 56-59 fathoms, rocks; 4,557, same, 53-54 fathoms, rocks; 4,574, off Cape Colnett, Lower California, 1,400 fathoms, bottom ?.

**Lumbrineris minuscula** nom. nov.

*Lumbriconereis minuta* Treadwell, Bull. U. S. Fish Comm., 1906, p. 1171, figs. 57, 58 (nom. preoc. *L. minuta* Theel, 1879).

Three very poorly preserved anterior ends of a species that is much like Treadwell's *L. minuta*, but differ in several respects and especially in the great prolongation of the limbate setæ, which, coupled with the fact that the specimens, and especially one male, are filled with genital products, leads to the suspicion that they are an epitokous phase of that species.

All three examples have a diameter of about 1 mm. Prostomium relatively smaller and more slender than usual in the genus. Eyes apparently wanting, but a small median brown spot on the dorsum of the prostomium immediately beneath the border of the nuchal fold. Parapodia poorly preserved, but evidently small and inconspicuous, and evidently with the lips little produced, though the postsetal is somewhat the longer. Most interesting are the setæ. From somite III to XXV all setæ are of the capillary bilimbate type. A few segments beyond XXV crochets appear and continue to the end of the pieces or beyond C. On anterior segments the limbate setæ agree with Treadwell's description, being long and slender, bilimbate and bent. They number ten or twelve and the ventral four or five are longer than the others. Farther caudad, after the crochets appear, the number of limbate setæ is reduced to a single short one dorsal to the crochets and five to six ventral to them in subacicular bundle. It is the latter that become so greatly elongated, projecting far beyond the ends of the parapodia and in one specimen equalling the diameter of the body. They are nearly straight with greatly restricted limbæ and the shaft continued into an excessively tenuous end. Anteriorly the crochets are restricted to two in the supra-acicular fascicle, but farther back two more are added in the subacicular fascicle. They are little, if any, stouter than the setæ, anteriorly margined for a short distance below the small head. Within a few segments, however, they lose the margin and assume the form figured by Treadwell.

While the jaws in general resemble Treadwell's figure, there are some differences which it seems probable result from imperfections in Treadwell's specimen. The maxillæ are remarkably massive for so small a species. Forceps jaws characterized by the very small base; maxillæ II with five teeth on the right and four on the left side, the first tooth on each side being very large and well-separated from the others by a wide interval. The anterior pairs of plates (III) are both very large, triangular and bear a single apical tooth. Mandibles pale with dark tips and differing little in form from those of *L. bifilaris*.

Station 4,390, off Santa Catalina Islands, 33° 02' 15" N., 120° 42' W., 1,350-2,182 fathoms, gray mud and fine sand.

***Araocoda semimaiculata*** sp. nov. Pl. XX, figs. 143-149.

Form slender, subterete, but owing to the prominence of the parapodia appearing widened and depressed in the middle and posterior regions. The type, in which the caudal end terminates in a small cone of regeneration, is 165 mm. long and 2.8 mm. wide, exclusive of the parapodia. Segments 278. Four other examples accompany the

type. Three small complete ones are from 52-93 mm. long and have from 135 to 209 segments, and a larger one, lacking the caudal end, is 155 mm. long, 2 mm. wide and has 235 segments.

Prostomium as long or slightly longer than wide, subovate, slightly depressed, the ventral face with a slightly impressed median area bounded by a pair of parallel furrows which pass into the mouth. Eyes four in a transverse row near the posterior border. In the two larger specimens the eyes are obscure, especially the outer larger pair; on the smaller ones they are much more distinct and the middle always decidedly smaller. Peristomium and succeeding achætatus segment together about as long as the prostomium, the former slightly the longer; lip but little furrowed and palpal pads at base of prostomium scarcely evident.

Segments all simple and sharply defined, varying from four to six times as wide as long, nearly terete, but the venter slightly flattened. Lateral or parapodial furrow slightly developed. Pygidium a minute cylinder bearing two or four very small padlike cirri.

Parapodia (Pl. XX, figs. 143-145) begin on III. The anterior are very small and inconspicuous, but they increase in size and become prominent farther back. The body is slightly flattened, cylindroid, constricted at the base and divided at the distal end by a vertical setigerous cleft into presetal and postsetal lips. The former is short and broadly rounded on all parapodia, the latter undergoes conspicuous change. On anterior parapodia (fig. 143) it is nearly as long as the body of the foot, moderately flattened and subtriangular, with the blunt apex directed upward and outward. It rapidly becomes longer, thicker and cylindroid and bends dorsad (fig. 144). Throughout the middle region it presents the appearance of a short finger crooked upward. Still farther back, continuing to increase in length and arising more from the ventral aspect of the foot, it takes a slightly spiral turn and a suberect posture and retains this character to the caudal end (fig. 145). On all parapodia the notopodium appears as a rather prominent but small angulated tubercle on the base of the dorsal face of the neuropodium.

Neuropodial acicula usually two or three, straight, tapered, pale, with the dark, bluntly pointed tips protruding a short distance beyond the surface. Notopodial acicula two or three slender fibers entering the notopodial tubercle.

Setæ few, from six to eight on anterior, diminishing to usually four on posterior parapodia. All are pale yellow, acute, bilimbate, more or less sigmoidly curved and geniculate at the first bend. The genic-

ulum is directed dorsad and is most strongly developed on the dorsal-most setæ which are also the longest. On anterior parapodia the margins of the setæ are smooth or nearly so (fig. 146); farther back the serrations become more prominent, especially on dorsal setæ, which also have a few transverse pectinæ at the base of the geniculum (fig. 147).

Jaws of two specimens dissected. Mandibles (Pl. XX, fig. 148) dense opaque black, the posterior half or two-fifths narrow and somewhat tapered, separated on the two sides by a wide median space, the anterior portion abruptly twice as wide, the two halves united by an extensive suture, the exposed tips slightly divergent with finely denticulated free margins. Maxillæ (Plate XX, fig. 149) also dense opaque black, the forceps jaws supported by a pair of small triangular carriers prolonged into tapered filaments about one and one-third times as long as the series of jaws, the forceps with massive bases and short, strongly hooked ends, the left bearing on its medial margin eight or nine stout teeth of diminishing size, the right about seven smaller teeth. Maxillæ II asymmetrical, the left short and stout with eight teeth, the right long and narrow with about thirteen teeth diminishing in size from before backward. III<sup>1</sup> is a curved piece bearing two teeth on each side; IV is irregular with five or six unequal teeth; V is also irregular with four or five slender teeth and the most anterior (VI) is a small piece with one slender tooth and a bifid base. A long ribbon-like band of chitin exceeding the forceps filaments in length extends caudad from the posterior maxillæ ventral to the forceps carriers.

In color some are pale gray and unspotted, but three of the specimens are blotched with three dorsal series of dusky bluish spots and the peristomium is deeply pigmented above. The cuticle is more or less iridescent.

Known only from station 4,496, Monterey Bay, off Santa Cruz Lighthouse, 10 fathoms, fine gray sand and rocks.

From *Aracoda cerulea* Schmarda, as redescribed by Ehlers, this species is abundantly separated, particularly through the characters of the jaws, which in fact depart materially from the form typical of the genus.

***Arabella attenuata* Treadwell?**

*Arabella attenuata* Treadwell, Bull. U. S. Fish Comm., XXIII, part III (1906), p. 1172, fig. 62.

A small portion of the middle of a large specimen about 3 mm. in

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<sup>1</sup>Through an oversight maxilla III was overlooked in labeling fig. 149.



diameter which may belong to this species. The parapodia bear large, semierect respiratory postsetal lobes as in *A. spinijera* Moore and also possess the conspicuously protruding spine and the winged and toothed setæ of that species, though the latter are less distinctly geniculate.

Station 4,351, off Point Loma Lighthouse, Monterey Bay, 423-488 fathoms, soft green mud.

***Drilonereis falcata*** sp. nov. Pl. XX, figs. 150-154.

A typical member of the genus known from incomplete worms only. The type consists of an anterior piece of 188 segments, and a posterior of 41 segments, possibly belonging to the same individual, the middle region of which is wanting. Together the pieces measure 121 mm. long and have a maximum width of 1.2 mm. and a depth practically the same. Form linear, terete.

Prostomium elongated, ovate-elliptical, one and one-half or more times as long as wide, strongly depressed, the depth about two-fifths width, the greatest width being at the posterior end where the prostomium is mortised into the peristomium. No distinct nuchal organs or longitudinal grooves and no eyes above; a shallow median longitudinal groove below.

Peristomium and II achætous, about equal above and together about two-thirds as long as prostomium. Peristomium broadly excavated for half its length above for the insertion of the prostomium, produced forward below to form a prominent but simple bilobed lip, not sharply differentiated from the small palps.

Body segments of nearly uniform diameter, subterete or slightly depressed, the venter very slightly flattened, very firm and wiry anteriorly, softer behind. Segments sharply defined and very regular, simple anteriorly, biannulate behind, generally about one-half as long as wide, but exceeding this in middle region. Close to the caudal end the segments are abruptly contracted and depressed. Pygidium a minute ring, bearing four short, conical, equally divergent cirri. Cuticle very smooth, polished, iridescent. Color nearly uniform purplish-brown.

Parapodia (Pl. XX, figs. 150, 151) are set into slight lateral depressions and project straight out. Anteriorly (fig. 150) they are nearly as long as the segments, but gradually become smaller simultaneously with the elongation of the segments until they are only one-third as long, though near the caudal end they are again relatively longer. All are simple, short, truncated, cylindroid, setigerous tubercles with a small dorsal steplike tubercle representing the notopodium and a somewhat ventral, papilliform postsetal lobe which

is as long as the setigerous tubercle and projects straight out beyond it. No noteworthy changes in form of the parapodia occur throughout its entire length.

True setæ are all of one form (Pl. XX, figs. 151, 152), simple, bilimbate, sigmoid, tapered to an acute point and with a finely serrate margin and distinctly striated stem. Those in the dorsal part of the fascicle are usually longer. Beginning at XIII, IX or X in the several specimens, they are accompanied by a single yellow, stout, blunt, rodlike aciculum (fig. 151) which projects obliquely far beyond the surface from the ventral border of the setæ bundle. Farther back it becomes even stouter and reaches nearly or quite to the tip of the postsetal lobe.

The most distinctive characters of the species are found in the jaws (Pl. XX, figs. 153, 154). Mandibles rather large for the genus, black, shaped like a pair of broad snow-shoes with the tapering heels behind and united anterior to the middle by a broad chitinous band (fig. 153). Maxillæ black; forceps jaws (I) very strongly falcate and hamate with acute tips, stout at the base with massive, quadrate masticatory plates, the inner margin of which bears only three or four distinct small teeth and some obscure crenulations. Hinge-pieces of carriers (fig. 154) very small and strongly divergent from an irregular horizontal plate with attached fringed chitinous tendons at the united anterior ends of the long, slender, attenuated filaments, which barely exceed twice the length of the series of jaws. Large tooth plates, narrow and nearly straight or oblong, with a supporting flange or plate running nearly their entire length and meeting at nearly a right angle in a ridge bearing a series of six or seven teeth, the first of which is enlarged and talonlike, the remainder equal, regular, acute and recurved. Anterior to this plate on each side is a group of three small crowded tooth plates, each bearing a single, long, slender, strongly curved and very acute tooth on a V-shaped base. These represent III, IV and V (fig. 154).

Stations 4,451, Monterey Bay, off Point Pinos Lighthouse, 47-51 fathoms, green mud and sand; 4,460 (type station) same locality, 55-167 fathoms, green mud and gravel.

#### GLYCERIDÆ.

*Glycera capitata* Oersted.

*Glycera capitata* Oersted, Grönl. Ann. Dorsibr., 1843, p. 44, Tab. VII.

What is undoubtedly a variety of this species, differing in only a slight and variable degree from typical examples from the Atlantic Ocean, is not uncommon throughout this region. The principal

differences exhibited by these specimens is that the parapodia are longer with the postsetal lobes and neurocirrus much more elongated, slender and acute, and the appendages of the compound setæ longer and more slender. In all important respects, prostomium, parapodia, proboscis papillæ and jaws, the resemblance is very close.

All specimens are small, the largest varying from 40 to 46 mm. long with 98 to 109 segments and most being much smaller. All are largest in the proboscis region and tapered to a slender posterior region. Prostomium with eight rings beyond the enlarged base, the three terminal ones being very small. Body segments always distinctly triannulate.

The jaws are typical and the clavate proboscis thickly covered with slender conical papillæ and either eighteen or twenty longitudinal rows of larger ovate papillæ, both of which are exactly like those of Atlantic specimens.

*Glycera nana* Johnson is very closely related to *G. capitata*, the principal differences being that the segments of the former are only biannulate and that the lobes of the parapodia have slightly different forms. In this connection it should be noted that at least some of the specimens reported by me from San Diego under the name of *G. nana* (PROC. A. N. S., 1909, p. 259) are really small examples of other species. One of these is a young *G. robusta* Ehlers and the other a *G. rugosa* Johnson with completely retracted gills.

Specimens of *G. capitata* occur from the following stations: 4,343 off South Coronado Island, vicinity of San Diego, 60-155 fathoms, fine gray sand; 4,452, off Point Pinos Lighthouse, Monterey Bay, 49-50 fathoms, green mud and fine sand; 4,457, same locality, 40-46 fathoms, dark green mud; 4,464, same locality, 36-51 fathoms, soft dark gray mud; 4,485, off Santa Cruz Lighthouse, Monterey Bay, 39-108 fathoms, soft green mud and sand; 4,548, 4,549, 4,550 and 4,551, all off Point Pinos Lighthouse, Monterey Bay, 46-57 fathoms, coarse sand, shells and rock, except 4,550, where green mud and rock; 4,557, off Point Pinos Lighthouse, 53-54 fathoms, rock.

***Glycera tessellata* Grube.**

*Glycera tessellata* Grube, Arch. Naturgesch., XXIX, I, p. 41, Taf. IV, fig. 4.

This second European species as nearly as frequent and, at southern stations, as generally distributed in the region as *G. capitata*. The only obvious respect in which these examples appear to differ from European ones is in the possession of a smaller number of prostomial rings, for, whereas Ehlers attributes thirteen and McIntosh seventeen rings to this region, these have only eleven or twelve nearly equal rings above the enlarged base.

All of the specimens are stout and more or less inflated anteriorly in the proboscoidal region and taper rather abruptly into the slender and attenuated posterior half. All segments are biannulate. Several have the proboscis fully protruded, showing the very dense covering of very high slender papillæ, among which are a few somewhat stouter but otherwise similar papillæ. The jaw appendages differ from those of *G. nana* in having a much narrower basal wing.

The color is generally a rich orange-brown, most pronounced anteriorly, and only lacking on the smallest specimens, which are clear yellow.

This species has already been recorded from the North Pacific in the Gulf of Georgia and off Japan.

Stations 4,326, off Soledad Hill, Point La Jolla, vicinity of San Diego, 243-264 fathoms, soft green mud; 4,399, Lat. 32° 44' 50" N., Long. 117° 48' 45" W., 264-285 fathoms, fine gray sand and rock; 4,410, off Santa Catalina Island, 143-245 fathoms, gray sand, shells, gravel and rocks; 4,415, off Santa Barbara Island, 302-638 fathoms, green mud; 4,418, same locality, 238-310 fathoms, dark green mud, sand and rock; 4,430, off Santa Cruz Island, 197-281 fathoms, black sand, pebbles and rock; 4,431, off Santa Rosa Island, 38-45 fathoms, varied bottom; 4,463, off Point Pinos Lighthouse, Monterey Bay, 48-111 fathoms, rocky.

*Glycera alba* Rathke *macrobranchia* subsp. nov.

*Glycera alba* Rathke, Nov. Act. Acad. Nat. Cur., XX, p. 173, Tab. IX, fig. 9.

Represented by a single long, slender, nearly complete specimen. Length 99 mm., width 2.7 mm. Number of segments 129, probably 25 or 30 at the caudal end missing.

The segments are all strongly biannulate, with the middle or foot-bearing annulus somewhat larger. Parapodia small, in middle region about one-third as long as the body width. The dorsal gills begin at XXII and reach a very large size before L, remaining nearly unaltered to the end of the piece. Compared with European and Japanese examples of the species, the gills of this specimen are much larger and the postsetal lobe smaller.

The jaws are unknown, but the half-protruded proboscis was studied. Its surface is very finely granular from the presence of very numerous small, pediculated, oval papillæ, bearing inclined, winged, cuticular terminal plates, among which are scattered some much smaller subconical papillæ. Compared with typical examples of the species, these papillæ are distinctly larger, with relatively shorter stalks and less pronounced wings on the end plates.

The single specimen is labelled Beaver Shoal, San Diego Bay, mud, 7/19/05.

*Glycera branchiopoda* sp. nov. Pls. XX, XXI, figs. 155-159.

A small, rather slender species, characterized by the well-developed ligulate dorsal and ventral gills. The type is 90 mm. long without proboscis; the maximum width, exclusive of parapodia, 2.8 mm., with parapodia 3.5 mm. Proboscis, not fully extended, 22 mm. long, 2 mm. in diameter at base and 3.5 mm. at the distal end.

Prostomium of the usual form, consisting of a broad, rugous, basal region constituting about two-fifths of its length and a slender, somewhat depressed conical portion divided into seven annuli decreasing in size regularly from base to apex, the basal three aggregating considerably more than one-half of its length. Terminal segment very small, dome-shaped, bearing the four minute apical tentacles which are divergent and all directed somewhat ventrad, the dorsal slightly longer than the ventral. There is a median dorsal and a median ventral groove, the latter being the better developed.

Peristomium closely united with prostomium, divided below by the large mouth. Metastomial region increases in diameter to about XL, from which the body tapers to the caudal end. Anterior segments very short and crowded, the first with modified parapodia closely crowded against the head. Remainder of the body nearly terete, the segments strongly arched above and slightly flattened below. Anteriorly they are at least eight times as wide as long, but increase gradually in length while decreasing in width until the ratio is two to one. All segments are strongly and completely triannulate and the annuli are of nearly equal width, only the third or postpodal being slightly larger than the others, especially posteriorly where they are marked above by a straight cross-furrow. On the short and crowded anterior segments the prepodal annulus is frequently united with the middle annulus laterally and partly bears the parapodia. Middle annulus, though never enlarged, is frequently conspicuous by reason of its paler color. Pygidium unknown.

Parapodia characteristic, the anterior short and deep, the posterior longer and more cylindrical. First two situated high by the sides of the mouth with the notopodium much reduced and notocirrus totally lacking, consequently consisting of a neuropodium bearing a short, rounded postsetal lip and a longer acute asymmetrical presetal lip. Remaining parapodia (Pl. XXI, figs. 158, 159) all biramous, the postsetal lip short, broad, and undivided, broadly rounded, often slightly emarginated on middle segments. Presetal lip deeply cleft

into a dorsal and a ventral lobe. On anterior segments (fig. 157) these present no striking peculiarities; both are foliaceous at the base where the ventral lobe is much the larger, while the distal portion, which is separated by a slight constriction, is longer and acute in the dorsal lobe and usually obtuse in the ventral lobe. Neurocirrus prominent, attached to middle of ventral face of neuropodium, somewhat grooved and embracing the neuropodium at the base and tapered to an acute tip which usually diverges more or less from the foot. Notocirrus a small globoid or subcylindrical papilla situated on the side of the body well above the parapodium. Passing caudad, the foliaceous base of the dorsal presetal lobe is gradually reduced and the distal part enlarged to form a gill which becomes fully established at about XXXV (fig. 158). Throughout the middle region and nearly if not quite to the caudal end this lobe forms a prominent, subligulate, erect gill rising from the dorsum of the end of the foot and fully equaling or exceeding the latter in length (fig. 159). The ventral presetal lobe does not become branchiform, but elongates and finally takes a slender finger-like form (fig. 159). Simultaneously with the development of the dorsal gill a ventral gill develops from the modification of the neurocirrus. This is similar in form to the dorsal gill, but when fully developed (figs. 158, 159) becomes even larger, reaching beyond the end of the postsetal lip. Near the caudal end it undergoes considerable reduction in size. Both dorsal and ventral gills are thin-walled and sacular with large cavities communicating with the cœlom and a layer of longitudinal and slightly oblique muscle fibers by which they may be retracted.

Acicula two, corresponding to the two principal fascicles of setæ, both simple, nearly straight, tapered, pale rods, the ventral much the stouter. Setæ colorless, in three fascicles, a dorsal oblique row of very slender simple setæ, a middle horizontal and a ventral vertical series of compound setæ. The latter have slender shafts terminating in deep asymmetrical sockets and slender, tapered, finely punctated blades, with minute marginal denticulations. On the first two parapodia simple setæ are absent, but the dorsalmost compound setæ have very long slender blades. In general the blades of the compound setæ decrease in length from the dorsalmost ventrad and from the anterior end caudad.

Proboscis described from a cotype (station 4,517), this being the only one in which it is everted to the jaw pads. The nearly complete worm is 35 mm. long, the proboscis 12 mm. long, 1.5 mm. in diameter at the base and 3.2 mm. at the distal end. Clavate, the distal end

domed and terminated by sixteen large, soft papillæ flattened against one another in a circle at the base of the still retracted jaws. Surface proximad of these papillæ thickly covered with small cutaneous papillæ of three forms and sizes. The most numerous are tall, slender cones (Pl. XX, fig. 155a), the second are larger, low, truncate cones (fig. 155b) arranged in eighteen or twenty longitudinal rows along the muscle bands; the third are a few scattered and smaller papillæ (fig. 155c). All three kinds have a similar structure, with an apical pore at which a pair of refringent fibers end, and containing a few large sensory cells and a supporting framework. Jaws of the usual falcate form, strong, black, clawlike with expanded, hollow bases and an appendage consisting of a rod and a large thin, triangular, basal wing supported by a thickened marginal rib (fig. 156).

Color as preserved pale yellow.

Stations 4,517, off Point Pinos Lighthouse, Monterey Bay, 750-766 fathoms, green mud and sand; 4,525, same locality, 222 fathoms, soft gray mud; 4,527, same locality, 183-337 fathoms, hard sand; 4,528, same locality, 766-800 fathoms, soft gray mud; 4,574 (type), off Cape Colnett, Lower California, Lat. 30° 35' N., Long. 117° 23' W., 1,400 fathoms.

***Glycera rugosa* Johnson.**

*Glycera rugosa* Johnson, Proc. Bos. Sci. Nat. Hist., XXIX, pp. 409-411, Pl. 10, figs. 101, 102.

Owing to the complete retractibility of the branched gills of this species, their presence is easily overlooked as was done on a former occasion in hastily determining such a specimen from San Diego as *G. nana*. Careful examination in direct sunlight always renders visible the orifices through which the gills have been withdrawn. Those from station 4,454 are marked with quadrate black spots.

Stations 4,431, off Santa Rosa Island, 38-45 fathoms, varied bottom; 4,454, off Point Pinos Lighthouse, 65-71 fathoms, green mud, sand and gravel; 4,548, same locality, 46-54 fathoms, coarse sand, shells and rock.

***Glycera longissima* Arwidsson.**

*Glycera longissima* Arwidsson, Bergens Museums Aabog for 1898 (1899), pp. 23, 24, Pl. I, figs. 15, 19; *G. chilensis* Arwidsson, *ibid.*, pp. 24, 25, Pl. I, figs. 20, 21.

Arwidsson's two species are probably identical, as Ehlers has already indicated. This species is represented by a very large, practically complete example 305 mm. long and 8 mm. wide exclusive of the parapodia. Segments 230, a few of the most caudal and the pygidium missing.

Prostomium 12-annulate, the four apical tentacles minute. Segments strongly biannulate. Gills begin at XIV in the same position as in *G. rugosa*, but are much more complex than in that species. All are branched, but the most anterior and posterior have only two or three slender divisions. The most are very large and complex, reaching from their place of origin at the posterior dorsal part of the foot over most of its posterior face. The largest divide immediately at the base into three or four large branches, each of which spreads vertically into a flat plane divided irregularly several times into slender filaments. Most of the larger gills consist of thirty or forty filaments. Proboscis 53 mm. long and 7 mm. in diameter, but jaws not exposed, thickly covered with papillæ of the same form as those of *G. rugosa*. This specimen agrees rather better with the description of *G. chilensis*, especially in the form of the jaw appendage and the mode of branching of the gills.

Station 4,322, off San Nicolas Island, 31-32 fathoms, gray sand and shells.

#### GONIADIDÆ.

##### *Goniada annulata* Moore.

*Goniada annulata* Moore, Proc. Acad. Nat. Sci. Phila., 1905, pp. 549-553, Pl. XXXVI, figs. 45-48.

A considerable representation of this species, usually only one example from each station, shows a wide range of color variation from yellow through light brown, gray and dark brown to purple, usually more or less distinctly annulated, but some of the most deeply pigmented ones nearly uniform. Some of them are sexually mature. Notopodial setæ begin on XXXIII or XXXIV, in the latter case the preceding parapodium being usually provided with a small achætous notopodium. The sexual region, characterized by long swimming setæ and neural eye-spots, begins on different specimens at LIV, LV or LVI. The proboscis and its jaws and papillæ agree very closely with the types.

Stations 4,307, off Point Loma Lighthouse, 490-496 fathoms, green mud and fine sand; 4,326, off Point La Jolla, vicinity of San Diego, 243-264 fathoms, soft green mud; 4,325, same locality, 275-292 fathoms, green mud and fine sand; 4,352, off Point Loma Lighthouse, vicinity of San Diego, 549-585 fathoms, green mud; 4,353, same locality, 628-640 fathoms, green mud; 4,366, same locality, 176-181 fathoms, green mud; 4,369, same locality, 260-284 fathoms, green mud, sand and rock; 4,462, off Point Pinos Lighthouse, Monterey Bay, 161-265 fathoms, green mud; 4,508, same locality, 292-303



fathoms, soft green mud; 4,524, 4,525, 4,526, same locality, 204-239 fathoms, soft gray mud; 4,574, off Cape Colnett, 30° 35' N., 117° 23' W., 1,400 fathoms.

***Goniada brunnea* Treadwell.**

*Goniada brunnea* Treadwell, Bull. U. S. Fish Comm., 1906, p. 1174, figs. 67-69.

Several excellently preserved specimens of this species occur in the collection and permit some minor additions to Treadwell's description. The largest individual is 111 mm. long with a maximum width of body in the anterior region of 1.8 mm. and between the tips of the parapodia of about 3 mm., the corresponding measurements of the posterior region being 2.6 and 4.2 mm.

Prostomium shaped as in Treadwell's figure, composed of from seven to nine equal rings above the base, the higher numbers in small specimens. As Treadwell supposed from the appearance of his, in this respect imperfectly preserved, specimen, the apical tentacles are biarticulate, the larger basal joint clavate and the minute terminal piece retractile. Parapodia are as figured by Treadwell, but his figure 68 is inverted. Notopodia with setæ appear abruptly at XLIV or XLV. Treadwell says at L. The distinction between the two regions of the body is never sharply indicated. Usually the anterior region is of a paler color and neural eye-spots, having the form of short dashes, and swimming setæ begin at about LVI. Pygidium a minute obliquely truncate cylinder with a somewhat thickened marginal welt and no cirri in place. The color is pale brown or yellowish-brown, either with paler annulations at the furrows or dusky markings, paling to clear yellow posteriorly.

No specimen has more than a small portion of the proboscis protruded and the jaws were seen by dissection. The large jaws are black, with four large, stout, clawlike teeth and apparently no small teeth. Dorsal arc of small jaws absent. Ventral arc of nine small black jaws apparently all bidentate with bilobed bases. Chevron jaws on the largest specimen eighteen, on a very small one nine on one side ten on the other and on other specimens fourteen or fifteen. Soft papillæ in a circle of eighteen. The surface of the proboscis appears smooth under a pocket lens, but when more highly magnified is seen to be thickly covered with minute hemispherical papillæ with an asymmetrical basal pore.

Stations 4,366, off Point Loma Lighthouse, vicinity of San Diego, 176-181 fathoms, green mud; 4,381, off South Coronado Island, 618-654 fathoms, green mud; 4,457, off Point Pinos Lighthouse,

Monterey Bay, 40-46 fathoms, dark green mud; 4,464, same locality, 36-51 fathoms, soft dark gray mud; 4,480, off Santa Cruz Lighthouse, 53-76 fathoms, dark green mud and sand.

*Glycinde armigera* sp. nov. Pl. XXI, figs. 160-171.

A slender species with the two regions not sharply differentiated. Length of type 81 mm., maximum width near middle, body only 1.8 mm., between tips of parapodia 3.1 mm. Number of segments 178. The largest example is 118 mm. long and has 191 segments.

Prostomium (Pl. XXI, fig. 160) much elongated, equal to the first seven segments, very slender and acutely conical, depressed. Base or oral region coalesced with peristomium, forming a somewhat swollen region wider than second setigerous segment and divided by an indistinct cross-furrow. Attenuated distal part divided very regularly into sometimes eight, sometimes nine, equal wings, the apical one bearing four small tentacles with clavate basal joints and minute cylindrical retractile distal joints. Median dorsal and ventral fields broad, smooth and continuous for entire length with the cross-furrows shallow, the lateral fields bounded by deep dorsal and ventral grooves and much more deeply cut by the interannular furrows. Mouth a small crescentic slit within the enlarged basal region and bounded laterally by the small palps. Eyes one pair, minute, black, widely separated on basal region, frequently indiscernible on larger specimens; no apical eyes.

Peristomium united with base of prostomium, forming the simple posterior lip and bearing a pair of small parapodia. Anterior end of body very slender, at first narrower than the oral region of head, terete; the segments well-defined, simple, slightly flattened below and in the parapodial field, strongly arched above with a narrow, somewhat softened dorsal field. The segments very gradually increase in both diameter and length to the point of greatest width (about LX), where they are about three times as wide as long. The two regions are less sharply differentiated than in many species, but a few segments behind the point of greatest width of the anterior region a slight constriction occurs, followed at somite LXX to LXXVI on different specimens by a more or less obvious increase in size of the parapodia accompanied by the presence, in mature examples, of genital products in the cœlom. The neural eye-spots, which take the form of short brown —s crossing the intersegmental furrows in the neural line, become conspicuous at the same place, but may be traced much farther forward, often to about L, gradually becoming fainter. Segments of

posterior region somewhat depressed, relatively shorter and more crowded than anteriorly and gradually tapered to the caudal end.

Pygidium a minute wing bearing a pair of long, very slender, flagelliform subanal cirri at least equal to the greatest width of the body, including the parapodia, and often one-third longer.

Parapodia situated near the ventral level anteriorly, extending their entire depth on most of the posterior region, all long and slender, those at the anterior end of the anterior region and throughout the posterior region equalling the width of the segments or, near the caudal end, exceeding them. As far as somite XXIX they are uniramous. The first foot (fig. 160) is small, with a minute setigerous tubercle nearly concealed between the much longer dorsal and ventral cirri. Succeeding ones gradually enlarge and the next few have the neuropodium divided into presetal and postsetal lobes of nearly equal length, the former broad and with an axial prolongation, the latter narrow and tapered (fig. 160). Dorsal and ventral cirri are about one-fourth longer than the neuropodium, moderately slender and tapered to blunt points, the former with a pitlike depression and glandular swelling near the base, beyond which it is bent somewhat abruptly dorsad, the latter nearly straight. On still succeeding somites all parts of the parapodium become increasingly compressed and foliaceous and the neuropodium longer than or at least equal to the cirri. On typical parapodia of this region (Pl. XXI, fig. 162) the broadly ovate postsetal lip is longer than the presetal lip, which is broadly obcordate petalliform with a tongue-shaped prolongation arising from the sinus. Neurocirrus about as long as neuropodium, compressed, of nearly uniform width to near the bluntly triangular tip. Notocirrus always irregular and somewhat distorted in outline, the base somewhat contracted, the distal part subovate, somewhat foliaceous and more or less abruptly bent dorsad.

At somite XXX a small notopodium appears abruptly anterior to the base of the notocirrus and immediately consists of a small setigerous tubercle, a short presetal lip and a longer postsetal lip. Through the remainder of the anterior region the biramous parapodia undergo no marked change, but with the beginning of the posterior sexual region (about somite LXX to LXXVI) they become distinctly larger and the rami better differentiated. Typical parapodia of this region (fig. 163) are large and deep with the neuropodium much exceeding the notopodium, compressed, somewhat widened distally into a broadly rounded acicular tubercle enclosed between broadly foliaceous, more or less irregularly ovate, presetal and postsetal lips, of which the

latter is somewhat the longer and the former marked by a slight constriction separating a distal portion corresponding to a much broadened lingulate process of anterior parapodia. Neurocirrus much shorter than neuropodium and divergent from it. The notopodium consists of a deep postsetal lip broadly attached to the notocirrus above with a slight emargination at the tip of the aciculum, and a small subovate presetal lip or process just ventral to the end of the aciculum. Notocirrus shaped much like neurocirrus, but shorter and lacking the basal depression and bending which characterizes anterior notocirri. Toward the caudal end the rami are relatively longer and more divergent.

Acicula in each ramus single, rather stout, straight, tapering rods ending in blunt points ending flush with the surface, the neuropodial being sometimes slightly bent at the tip. Neuropodial setæ in a broad spreading fan-shaped fascicle of one series, divided into nearly equal dorsal and ventral groups by a considerable interval at the aciculum into which the tonguelike prolongation of the presetal lip enters. On the type they are distributed as follows: somite X 16 supra-acicular and 14 subacicular, XXV 21 and 22, L 23 and 22, C 28 and 24. They are all of one kind, compound, capillary, slender and colorless, the gently curved shafts slightly enlarged at the distal end (fig. 164) to form a bifurcate socket with unequal limbs, the longer of which is faintly toothed. Appendages very delicate, slender, tapered, more or less curved, very finely punctate and along the edge finely fringed. They are shortest at the dorsal and ventral borders of the fascicles and gradually increase in length to acicular borders. Except that they are very long and slender on the middle segments, there is no obvious distinction between these setæ on the two regions of the body. Notopodial setæ (fig. 165) are few, three supra-acicular on XXX, three supra-acicular and two subacicular on L and four and three, respectively, on C. They are simple, colorless, delicate and very small, with a peculiar knoblike prominence on one side, beyond which they are prolonged into a very slender, acute tip. On more anterior parapodia these tips are exposed, but farther back they are shorter and concealed between the notopodial lips.

Proboscis, when fully retracted, reaches to somite XLIX, where the jaws lie. None of the specimens has it fully everted. It is most fully so on a cotype (station 4,480) on which it is 8 mm. long and 2 mm. in diameter, cylindroid, of uniform diameter, with four broad longitudinal ridges (one dorsal and one ventral pair) bearing four bands of horny papillæ or paragnaths. These bands extend for nearly the entire length of the eversible proboscis from the jaws nearly to

the base, where they dwindle away. When the proboscis is everted the paragnaths become more or less erect and form a formidable and bristling armature. The ventral bands are borne on a pair of rather sharp ridges and each consists of two series of horny papillæ, those of the more medial series (Pl. XXI, fig. 167) being larger with broad crescentic, flat bases and somewhat bent, acute, conical tops. Those of the more lateral series are more complex (fig. 168), about one-third to one-half as high as the inner papillæ, truncate and bent and bearing on the convex side a thick, horny scale or plate with three short spines at its lower border. Both kinds have a subapical pore and both become smaller toward the jaws, to which the bands nearly reach. Papillæ of the dorsal bands are larger and stouter, especially those of the inner or more medial series, which are clawlike, directed toward the middle line, with a broad base and subapical pore (fig. 169). Supporting these, between and behind them, are three irregular rows of somewhat smaller papillæ similar to the principal ones, except that they are more or less bifid at the apex, a feature which is very obvious on the tall papillæ at the middle of the series (fig. 170). All of these papillæ are very hard and horny and continue to the jaws without material decrease in size, but in the opposite direction, toward the base of the proboscis, gradually become reduced. Between the four armed bands are a few minute spheroid papillæ with roughened summits (fig. 171).

The circle of soft jaw papillæ appears to comprise twenty. Jaws black, the principal pair (fig. 166*a*) ventral, the width of four or five soft papillæ apart, with three (sometimes four) large, clawlike teeth and on the medial side an additional very small tooth or none. No ventral arc of small jaws. Dorsal arch of about thirty small, double, quadridentate jaws consisting of a larger anterior and a smaller posterior pair mostly like *b* (fig. 166), but a few like *c*.

Color variable, pale yellow, light brown, often with bluish reflections, drab, etc., more or less mottled with dusky, and those from station 3,454 exhibiting a few quadrate black spots. The general color of the type is a clear amber-brown with the furrows and median dorsal field bluish-gray and the prostomium pale gray. In the posterior region the color is almost entirely blue-gray, except on the parapodia which retain the brown. Neural eye-spots dark brown, very conspicuous in the posterior region.

Represented usually by single specimens from the following stations: 4,309, 4,310, off Point Loma Lighthouse, near San Diego, 67-78 fathoms, fine sand, green mud and rocks; 4,332, same locality, 62-183

fathoms, gray sand and rock; 4,334, same locality, 514-541 fathoms, green mud and fine sand; 4,436, off San Miguel Island, 264-271 fathoms, green mud; 4,452, 4,453, 4,454, off Point Pinos Lighthouse, Monterey Bay, 49-71 fathoms, green mud, sand and gravel; 4,457, same locality, 40-46 fathoms, dark green mud; 4,464, 4,467, same locality, 36-54 fathoms, soft dark mud; 4,480, off Santa Cruz Lighthouse, 53-76 fathoms, dark green mud and sand; 4,548, off Point Pinos Lighthouse, 46-54 fathoms, coarse sand, shells and rocks; 4,550, same locality, 50-57 fathoms, green mud and rocks.

*Aricia nuda* sp. nov. Pl. XXI, figs. 172-176.

As usual in the genus, this is a very fragile worm, and no complete examples are known, but only four short anterior ends and a fragment from near the caudal end. The type comprises two pieces not certainly belonging to the same individual: an anterior piece of 41 segments, 31 mm. long, 5 mm. wide and 3.2 mm. deep at somite VIII, and a much more slender and gently tapered piece of 72 segments and evidently from near the caudal end.

Prostomium mammilliform or flattened dome-shaped, bearing a blunt, nipple-like apical palpode about one-half as long as the prostomium, the combined length of both being about equal to the basal width of the prostomium. An obscure, rather large pigment spot or eye at each side close to the base of the palpode. On the ventral side a pair of parallel longitudinal grooves include between them a slightly depressed area ending at the quadrate mouth which is bounded on the sides by the peristomium and behind by a lip derived chiefly from somite II.

Anterior end of body for the first fifteen segments depressed, distinctly wider than deep, both dorsal and ventral surfaces moderately convex. Segments increase rather rapidly in width to VIII or IX, then become more gradually narrower. They are generally from four to six times as wide as long. At XVI, coincident with the shifting of the parapodia dorsad, the segments become much shorter, deeper, much more strongly convex below and flatter above. These conditions are maintained in the slender posterior region. There is no trace of the pectinated ventral fold or ventral rows of papillæ characterizing the more typical species of the genus. Walls of anterior part of body firm, of posterior region rather soft and translucent. Pygidium unknown.

Parapodia begin on I and are biramous throughout, the first fifteen differing from the others in the lateral position and large size of the neuropodium and the fimbriated or pectinated postsetal membrane.

The first two or three are smaller and of simpler structure than the others, consisting of small contiguous notopodial and neuropodial setigerous areas and behind each a postsetal lobe of which the notopodial is narrow, erect and pointed triangular, the neuropodial a low, broad, feebly pectinated fold, corresponding to the larger size of the latter. The neuropodium increases in size rapidly and soon becomes a low platform rising toward the caudal margin and bearing the setæ in a close phalanx of several, gradually rising tiers. They attain the maximum size at IX to XIII on which the setæ palisade is about four times as deep as long, and the now conspicuous postsetal fold bears twelve to fourteen or fifteen marginal processes (Pl. XXI, fig. 172), of which the dorsal is frequently somewhat larger than the others and occupies a more detached position above the setæ. On somites XII to XV, inclusive, the ordinary palisade setæ are much reduced and in part replaced in the dorsal portion of the posterior row by a few stout spines, the dorsalmost of which is very large and provided with a special cirrus, at the base of which opens a large pyriform gland, sometimes visible to the naked eye as a whitish swelling on the surface of the postsetal fold (Pl. XXI, fig. 174). At the same time the entire neuropodium undergoes reduction from the ventral side and the postsetal fold becomes smaller with few marginal processes. Except that it gradually shifts dorsad and becomes larger, with a conspicuous asymmetrical wing on the ventral side of the base, the notopodial postsetal lobe undergoes no change in the anterior region. At somite XVI the neuropodium becomes abruptly reduced in size, turned dorsad as a narrow erect process, which may bear one or two small papillæ on its lateral margin but often lacks them, and is elevated upon a winglike compressed base which unites it to and also bears the notopodium. Just above its base the neuropodium is constricted, and distally is divided into a short, truncate, postsetal lip and a longer postsetal and ventral acute conical lip (Pl. XXI, fig. 173) between which the acicula end and the small tuft of setæ arises. The notopodium of XVI consists of a setigerous tubercle bearing a large spreading fascicle of setæ and provided with an erect, broad, lamellar, asymmetrical ovate, postsetal lip which is abruptly constricted at the end to a slender attenuated tip reaching nearly to the tips of the setæ. On succeeding segments parapodia (Pl. XXI, fig. 173) continue to change in the direction initiated on XVI, the thin basal plate rising higher and the notopodia and neuropodia becoming more slender and erect until they become strictly dorsal, with the two small erect rami elevated on a lamelliform pedicle. The lips of the neuropodium

remain much as described, the presetal short and truncate, the postsetal longer and acute. The notopodial presetal lip is obsolete and the postsetal lip becomes much elongated, narrow and acute, with strongly constricted base. The postsetal lobes of both rami contain numerous irregular long, longitudinal vascular loops quite different in arrangement from those in the gills. Neurocirrus (fig. 173) a slender, pointed process rising a short distance ventral to the neuropodium, obsolete in the anterior region and becoming very small toward the caudal end. Notocirrus wanting unless represented by the gills.

Acicula of anterior parapodia apparently a large number of simple tapering rods not easily distinguished from setæ. On posterior segments there are two or three notopodial and usually one neuropodial acicula, both very slender and tapered. On segments XIII to XV, inclusive, appears a series of five to seven stout, brown spines in a vertical row at the cephalic margin of the much reduced palisade of setæ and which are probably to be considered as modified acicula. The dorsalmost (Pl. XXI, fig. 174) is much larger than the others and projects very prominently and obliquely upward across the interramal space. At its base, as noted above, is a cirrus and large pear-shaped gland. Like the largest of the others, only the tips of which are exposed, the dorsalmost spine ends in a thickened, spearlike, acute point. Among the large spines are some smaller ones with attenuate tips.

Setæ are all simple and of one type in both rami, though differing considerably in proportions and structural details. Omitting the above-described spines, all are more or less acute, tapered and flexible. Notopodial setæ are generally longer and more slender and arranged in dense fan-shaped fascicles on anterior somites and in delicate tufts of a few setæ on posterior somites. Neuropodials of the anterior region form dense phalanges of four to six ranks in which the setæ increase in length and change somewhat in structure from before backward. On the posterior region they form erect tufts of very few setæ similar in every respect to the notopodials. On the first few parapodia notopodial and neuropodial setæ differ only in length. Both are colorless and slender. The basal portion of the exposed part contains a conspicuous spiral canal (Pl. XXI, fig. 175) wound round a central fibrous axis and more capacious on one side than on the other, so that the axis is somewhat eccentric. Farther out the canal becomes reduced and then obsolete on the side upon which it was least developed, thus leaving an asymmetrical camerated structure, often accompanied by a very minute serrulation which gradually disappears,



leaving nearly smooth, solid capillary tips. On the posterior region the more slender and elongated setæ have the structure of the more delicate parts of the anterior setæ, the basal region with its canal being absent and the shaft provided with minute appressed teeth. No bifurcate setæ, such as are present in *A. johnsoni*, can be detected in this species. In the neuropodium it is evident after a few somites that the shorter setæ of the first rank or two have become dark-colored and have lost both the external serrulation and internal cavity. These changes become emphasized for several segments. Setæ of the posterior rows are of the same type as the notopodial setæ, but have the basal canalization and cameration more evident and the slender solid tips less prolonged. At the ventral end of the fascicle is a small, somewhat isolated tuft of shorter setæ, some of which are simple spines finely serrulated along one margin and a few short blunt spines with the ends enclosed in a mucronate hood. All of these differentiations become more pronounced to somite XI, after which the stout acicular spines appear in association with a conspicuous reduction in the number and size of the other setæ, particularly those of the anterior rows. In this region the small ventral tuft is composed entirely of a few small hooded spines (fig. 176), below which is a second tuft of the largest canaliculated setæ remaining on the neuropodium. In the posterior region the neuropodial setæ have exactly the structure of the notopodial, but are fewer in number.

; Branchiæ begin on somite V of all specimens, rising from the dorsal area as a pair of foliaceous, rather broadly lanceolate processes barely reaching to the notopodia and separated by a distance greater than their length. Proceeding caudad, they regularly increase in length and size (Pl. XXI, fig. 172) until by somite XL their length is about three-fifths the width of the body, their form foliaceous lanceolate and posture erect. On the posterior piece they have become fully one-and-one-half times the body width and taper to filamentous tips, being therefore much elongated and very conspicuous (Pl. XXI, fig. 173). They show no special areas of strong ciliation, but are very richly vascular, having a large axial vessel with a spacious bulbous expansion at the base and a complex bipinniform system of very numerous lateral branches extending to the margins. Anteriorly the gills are quite free from each other and from the notopodia, but as the parapodia assume the dorsal position they become united by a transverse membranous fold that crosses the whole width of the dorsum.

Proboscis very imperfectly known, only the ends of a few of the lacinated divisions being exposed on any of the specimens.

Color at anterior end pale yellow, fading out and leaving the posterior end nearly colorless and much more translucent. A rather conspicuous series of median dorsal brown spots begins on VII and continues to the caudal end. On some of the specimens the anterior spots are double. The only other color is a slight anterior cuticular iridescence, the obscure eye-spot (?) on each side of the prostomium and a duskiness of certain of the palisades of setæ.

Most of the examples are sexually mature, both males and females occurring, the type being of the latter sex. A specimen from station 4,306 is noteworthy because of the occurrence of abnormalities, the gills of many of the anterior segments being bifid and the postsetal lobes more or less divided into slender often lacinated processes.

Stations 4,306, off Point Loma Lighthouse, vicinity of San Diego, 207-497 fathoms, green mud, fine sand and gravel; 4,327, off Soledad Hill, Point La Jolla, vicinity of San Diego, 263-330 fathoms, soft green mud; 4,339 (type), off Point Loma Lighthouse, 241-369 fathoms, green mud.

#### EXPLANATION OF PLATES XV-XXI.

Unless stated otherwise, all drawings are made from the types.

PLATE XV.—*Chloeia pinnata*, figs. 1-6 (from cotype, station 4,475).

Fig. 1.—Posterior ventral bifid notopodial seta from X,  $\times 98$ .

Fig. 2.—Tip of serrated notoseta from X,  $\times 250$ .

Fig. 3.—Tip of spurred anterior notoseta from near notocirrus of X,  $\times 98$ .

Fig. 4.—*a* and *b*, respectively, tips of stout and slender neurosetæ from X,  $\times 250$ .

Fig. 5.—Tip of anterior neuroseta from X,  $\times 98$ .

Fig. 6.—Same of somite I,  $\times 250$ .

*Euprosyne limbata*, figs. 7-11.

Fig. 7.—Fifth gill from somite X, incomplete,  $\times 40$ .

Fig. 8.—Main division of 3d gill from X,  $\times 56$ .

Fig. 9.—Large notoseta of X,  $\times 98$ .

Fig. 10.—Ventral neuropodial of X,  $\times 98$ .

Fig. 11.—Dorsal neuropodial of X; *a*, end of another with wider angle of divergence of the spur,  $\times 98$ .

*Euprosyne dumosa*, figs. 12-17.

Fig. 12.—Gill from somite XV of cotype (station 4,470),  $\times 56$ .

Fig. 13.—Large smooth notopodial seta from 2d row of X,  $\times 98$ .

Fig. 14.—Small same from 3d row,  $\times 98$ .

Fig. 15.—Bifid serrate notoseta from X,  $\times 98$ ; *a*, tip of same,  $\times 250$ .

Fig. 16.—Ventral neuroseta from XV,  $\times 98$ .

Fig. 17.—Dorsal same,  $\times 98$ .

Fig. 18.—*Nereis procera*, parapodium L of male epitoke from station 4,355,  $\times 40$ .

Fig. 19.—*Platynereis agassizi*, two mature eggs from cœlom of epitoke from station 4,355,  $\times 56$ .

*Eunice multipectinata*, figs. 20-23.

Fig. 20.—Parapodium and gill from somite XXV,  $\times 17$ .

Fig. 21.—Compound seta from XV,  $\times 250$ .

Fig. 22.—Pectinate seta from L,  $\times 440$ .

Fig. 23.—A rather slender ventral crochet from CL,  $\times 250$ .

*Nothria pallida*, figs. 24-28.

- Fig. 24.—Anterior view of 2d parapodium,  $\times 24$ .  
 Fig. 25.—Posterior view of 4th parapodium,  $\times 24$ .  
 Fig. 26.—Hooded crochet from IV,  $\times 360$ .  
 Fig. 27.—Pectinate seta from LXXV,  $\times 440$ .  
 Fig. 28.—End of crochet from XXV,  $\times 250$ .

PLATE XVI.—*Marphysa conferta*, figs. 29-34.

- Fig. 29.—Head and first four segments.  
 Fig. 30.—Parapodium X with gill,  $\times 56$ .  
 Fig. 31.—Parapodium L,  $\times 56$ .  
 Fig. 32.—Compound seta from X,  $\times 440$ .  
 Fig. 33.—Pectinate seta from L,  $\times 440$ .  
 Fig. 34.—Crochet from L,  $\times 360$ .

*Nothria pallida*, figs. 35-37.

- Fig. 35.—Parapodium L,  $\times 24$ .  
 Fig. 36.—Mandibles of cotype (station 4,401) from the venter,  $\times 33$ .  
 Fig. 37.—Maxillæ of same from the dorsum,  $\times 33$ .

*Nothria species?*, figs. 38-40.

- Fig. 38.—Parapodium XXV,  $\times 24$ .  
 Fig. 39.—Compound crochet from III,  $\times 440$ .  
 Fig. 40.—End of simple crochet from XXV,  $\times 250$ .

*Nothria hiatidentata*, figs. 41-50.

- Fig. 41.—Anterior end from the dorsum,  $\times 5$ .  
 Fig. 42.—Anterior aspect of 2d parapodium,  $\times 24$ .  
 Fig. 43.—Same of 4th parapodium,  $\times 24$ .  
 Fig. 44.—Parapodium L,  $\times 17$ .  
 Fig. 45.—Tip of a much worn large spine from III,  $\times 250$ .  
 Fig. 46.—End of slightly worn crochet from IV seen in  $\frac{1}{4}$  face,  $\times 250$ .  
 Fig. 47.—End of a pectinate seta from IV,  $\times 440$ .  
 Fig. 48.—End of a large hooded crochet from L,  $\times 250$ .  
 Figs. 41-48 are all drawn from a cotype (station 4,387).

## PLATE XVII.—

- Fig. 49.—Ventral view of mandibles of cotype,  $\times 24$ .  
 Fig. 50.—Dorsal view of maxillæ of same,  $\times 24$ .

*Onuphis parva*, figs. 51-57, all from cotype (station 4,446).

- Fig. 51.—Posterior aspect of parapodium III,  $\times 56$ .  
 Fig. 52.—Anterior aspect of parapodium V,  $\times 56$ .  
 Fig. 53.—Same of parapodium XXV,  $\times 56$ .  
 Fig. 54.—End of compound crochet of IV,  $\times 600$ .  
 Fig. 55.—Pectinate seta from XXV,  $\times 600$ .  
 Fig. 56.—End of hooded crochet from XXV,  $\times 600$ .  
 Fig. 57.—Slender crochet without guard from L,  $\times 600$ .

*Onuphis nebulosa*, figs. 58-68, all from cotype (station 4,454).

- Fig. 58.—Anterior aspect of parapodium III,  $\times 33$ .  
 Fig. 59.—Same of V,  $\times 33$ .  
 Fig. 60.—Same of L, with gill,  $\times 33$ .  
 Fig. 61.—End of a compound crochet from II,  $\times 360$ .  
 Fig. 62.—End of a compound crochet from VI,  $\times 360$ .  
 Fig. 63.—End of a transition compound seta from X,  $\times 440$ .  
 Fig. 64.—Pectinate seta from X,  $\times 440$ .  
 Fig. 65.—Transition hooded crochet from XV,  $\times 440$ .  
 Fig. 66.—Hooded crochet from LXXV,  $\times 440$ .  
 Fig. 67.—Ventral view of mandibles,  $\times 33$ .  
 Fig. 68.—Dorsal view of maxillæ,  $\times 33$ .

*Onuphis vexillaria*, figs. 69-76.

- Fig. 69.—Anterior aspect of parapodium III,  $\times 24$ .  
 Fig. 70.—Same of V,  $\times 24$ .  
 Fig. 71.—Same of L with gill,  $\times 24$ .  
 Fig. 72.—End of compound crochet from IV,  $\times 440$ .  
 Fig. 73.—Pectinate seta from a posterior segment,  $\times 440$ .  
 Fig. 74.—Tip of a crochet from L,  $\times 360$ .

Fig. 75.—Ventral aspect of one-half of a probably abnormal mandible, represented cut in two,  $\times 24$ .

Fig. 76.—Dorsal aspect of maxillæ,  $\times 24$ .

PLATE XVIII.—*Diopatra ornata*, figs. 77–85.

Fig. 77.—Anterior aspect of parapodium III,  $\times 24$ .

Fig. 78.—Anterior aspect of parapodium XV, with gill,  $\times 24$ .

Fig. 79.—Large compound crochet from 1st foot,  $\times 360$ .

Fig. 80.—A slender compound crochet from 3d foot,  $\times 360$ .

Fig. 81.—A semi-articulated subacicular seta from somite VI,  $\times 360$ .

Fig. 82.—A pectinate seta from C,  $\times 360$ .

Fig. 83.—End of a large simple guarded crochet from C,  $\times 360$ .

Fig. 84.—Ventral aspect of left half of mandible,  $\times 24$ .

Fig. 85.—Dorsal view of maxillæ of cotype (station 4,519),  $\times 17$ .

*Hyalinæcia juvenalis*, figs. 86–95.

Fig. 86.—Anterior aspect of parapodium of III,  $\times 33$ .

Fig. 87.—Posterior aspect of parapodium of V,  $\times 33$ .

Fig. 88.—Anterior aspect of parapodium XXV, with gill,  $\times 33$ .

Fig. 89.—Crochet from III,  $\times 360$ .

Fig. 90.—Crochet from XXV,  $\times 250$ .

Fig. 91.—Limbate seta from ventral fascicle of XXV,  $\times 360$ .

Fig. 92.—Pectinate seta from L,  $\times 360$ .

Fig. 93.—Left mandible of cotype from venter,  $\times 33$ .

Fig. 94.—Same of type,  $\times 33$ .

Fig. 95.—Maxillæ of type from the dorsum, somewhat crushed,  $\times 33$ .

Figs. 86, 87, 88 and 93 are from a cotype (station 4,431).

Fig. 96.—Unworn tip of a hooded crochet of a young specimen of *Hyalinæcia tubicola stricta*, seen in  $\frac{1}{4}$  face,  $\times 600$ .

Fig. 97.—Same from L of a full-grown specimen,  $\times 250$ .

*Onuphis parva*, figs. 98, 99.

Fig. 98.—Cephalic end of mandible of a cotype (station 4,475), ventral aspect,  $\times 56$ .

Fig. 99.—Dorsal aspect of the maxillæ of the same,  $\times 56$ .

Fig. 100.—Dorsal view of anterior end of *Onuphis nebulosa*,  $\times 9$ .

PLATE XIX.—*Ninoë gemmea*, figs. 101–109.

Figs. 101–104.—Parapodia of V, XV, XXV and CXXV, respectively, profile outlines as seen from in front,  $\times 33$ .

Fig. 105.—Limbate seta from XXV, *a* and *b*, respectively, profile and  $\frac{3}{4}$ -face views,  $\times 98$ .

Fig. 106.—Crochet from XXV,  $\times 98$ ; *a*, tip of another,  $\times 250$ .

Fig. 107.—End of crochet from C,  $\times 440$ .

Figs. 108, 109.—Ventral view of mandibles and dorsal view of maxillæ, respectively, of cotype (station 4,523),  $\times 24$ .

*Ninoë fusca*, figs. 110–118.

Fig. 110.—Prostomium and peristomium from above,  $\times 9$ .

Figs. 111–113.—Parapodia X, XXV and C, the first as seen from behind, the others from in front,  $\times 82$ .

Fig. 114.—Supra-acicular limbate seta from X,  $\times 250$ .

Fig. 115.—Same from C,  $\times 250$ .

Fig. 116.—Crochet from C,  $\times 250$ .

Fig. 117.—Dorsal view of mandibles,  $\times 17$ .

Fig. 118.—Ventral view of maxillæ,  $\times 17$ .

*Lumbrineris japonica index*, figs. 119–127.

Figs. 119–121.—Parapodia X, C and CXVII, outlines as seen from in front, from cotype (station 4,406),  $\times 33$ .

Fig. 122.—Dorsal limbate seta from X,  $\times 98$ .

Fig. 123.—Very slender dorsal seta from L of specimen from station 4,405,  $\times 98$ .

Fig. 124.—Compound crochet from XX,  $\times 250$ ; *a*, head of same,  $\times 440$ .

Fig. 125.—Crochet of somite XLVI,  $\times 250$ .

Fig. 126.—Mandibles from dorsum,  $\times 9$ .

Fig. 127.—Maxillæ from venter,  $\times 9$ . All figures except 123 from cotype (station 4,406).

*Lumbrineris inflata*, figs. 128-132.

Figs. 128-129.—Outlines of parapodia X and C, as seen from in front,  $\times 56$ .

Fig. 130.—Two limbate setæ from X in profile and face views,  $\times 250$ .

Fig. 131.—Compound crochet from X,  $\times 440$ .

Fig. 132.—Simple crochet from C,  $\times 440$ .

PLATE XX.—*Lumbrineris inflata*, figs. 133 and 134 (cotype, station 4,496).

Fig. 133.—Ventral view of mandibles,  $\times 83$ .

Fig. 134.—Dorsal view of maxillæ,  $\times 83$ .

*Lumbrineris biflaris*, figs. 135-142.

Figs. 135-137.—Outlines of anterior aspects of parapodia X, C and CCL,  $\times 33$ .

Fig. 138.—Profile of ventral and face view of dorsal limbate seta from somite X,  $\times 98$ .

Fig. 139.—Limbate crochet from somite V,  $\frac{3}{4}$ -face view,  $\times 250$ ; *a*, profile view of tip of another,  $\times 440$ .

Fig. 140.—End of simple hooded crochet from C,  $\times 250$ .

Fig. 141.—Ventral view of mandibles of cotype (station 4,485),  $\times 9$ .

Fig. 142.—Maxillæ of same, forceps jaws dorsal, other pieces ventral,  $\times 9$ ,

*Arcoda semimaculata*, figs. 143-149.

Figs. 143-145.—Parapodia X, C and CCL, from in front,  $\times 33$ .

Fig. 146.—Dorsal seta from X,  $\times 250$ .

Fig. 147.—Middle seta from LXXXV,  $\times 250$ .

Fig. 148.—Outline of mandibles of cotype (station 4,496), — 17.

Fig. 149.—Maxillæ of the same from the dorsal aspect,  $\times 17$ . III, IV and V indicate maxillæ IV, V, and VI respectively, maxilla III being unlabeled.

*Drilonereis jalcata*, figs. 150-154.

Fig. 150.—Anterior aspect of parapodium X of cotype,  $\times 56$ .

Fig. 151.—Anterior aspect of parapodium C,  $\times 83$ .

Fig. 152.—Seta from XXV,  $\times 440$ .

Fig. 153.—Mandibles of cotype (station 4,460) from the dorsum,  $\times 33$ .

Fig. 154.—Maxillæ of same from venter,  $\times 33$ .

*Glycera branchiopoda*, figs. 155 and 156.

Fig. 155.—The three forms of proboscis papillæ from a cotype (station 4,517), *a*, *c* and *c*, respectively,  $\times 250$ .

Fig. 156.—Jaw appendage of the same,  $\times 56$ .

PLATE XXI.—*Glycera branchiopoda*, figs. 157-159.

Figs. 157-159.—Parapodia X, L and C, respectively, the first and last in caudal aspect,  $\times 40$ , L in cephalic aspect,  $\times 24$ .

*Glycinde armigera*, figs. 160-171.

Fig. 160.—Dorsal view of prostomium of cotype (station 4,310),  $\times 56$ .

Figs. 161-163.—Anterior aspects of parapodia V, XXV and C (concealed outlines dotted),  $\times 56$ .

Fig. 164.—Part of a shorter ventral neuropodial seta from XXX,  $\times 400$ .

Fig. 165.—Exposed portion of a notopodial seta from XXX,  $\times 400$ .

Fig. 166.—Elements of the circle of jaws; *a*, large ventral jaw,  $\times 125$ ; *b*, one from the dorsal arch,  $\times 250$ ; *c*, *c*, two forms of smaller size from the dorsal arch,  $\times 250$ .

Fig. 167.—Large paragnaths from the ventral bands, in profile and top view,  $\times 250$ .

Fig. 168.—Profile and top views of small papillæ (paragnaths) from ventral bands,  $\times 250$ .

Fig. 169.—Two papillæ (paragnaths) from dorsal bands near jaws,  $\times 98$ .

Fig. 170.—Large bifid paragnath from dorsal bands,  $\times 250$ .

Fig. 171.—Two of the small scattered papillæ,  $\times 250$ .

Figs. 166-171 are drawn from a cotype (station 4,548).

*Aricia nuda*, figs. 172-176.

Fig. 172.—Outline of parapodium and gill of X from behind,  $\times 17$ .

Fig. 173.—Same of L from in front,  $\times 24$ .

Fig. 174.—Large dorsal neuropodial spine with gland and cirrus from XV,  $\times 56$ .

Fig. 175.—Small portion of base of neuropodium of X; *a*, from the side; *b*, from front,  $\times 600$ .

Fig. 176.—Hooded spine from ventral part of neuropodium of XV,  $\times 250$ .